15-1008

In The United States Court of Appeals
For The Federal Circuit

ENCAP, LLC,

Appellant,

v.

THE SCOTTS COMPANY LLC,

Appellee.

APPEAL FROM THE UNITED STATES PATENT AND TRADEMARK OFFICE, PATENT TRIAL AND APPEAL BOARD IN IPR2013-00110

BRIEF OF APPELLANT ENCAP, LLC

Philip M. Weiss
Weiss & Weiss
410 Jericho Turnpike, Suite 105
Jericho, NY 11753
Phone: (516) 739-1500
Email: weissandweiss@aol.com

Aaron T. Olejniczak
Andrus Intellectual Property Law, LLP
100 East Wisconsin Avenue, Suite 1100
Milwaukee, WI 53202
Phone: 414-271-7590
Fax: 414-271-5770
Email: aarono@andruslaw.com

Counsel for Appellant

Dated: December 15, 2014

CERTIFICATE OF INTEREST

Counsel for the Appellant, Encap, LLC, certifies the following:

1. The full name of every party or amicus represented by me is: Encap, LLC.

2. The name of the real party in interest (if the party named in the caption is not the real party in interest) represented by me is: Not applicable.

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are: FI, Inc. a privately held corporation is the majority owner of Encap, LLC.

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court are: Philip M. Weiss, Weiss & Weiss and Aaron T. Olejniczak, Andrus Intellectual Property Law, LLP.

Dated: December 15, 2014

/s/Philip M. Weiss
Philip M. Weiss

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STATEMENT OF RELATED CASES

No other appeal from this *Inter Partes* Review before the United States Patent and Trademark Office was previously before this or any other appellate court. The patent at issue in this appeal, U.S. Patent No. 6,209,259, is also the subject of the pending *Ex Parte* Reexamination Control No. 90/012,183 filed by The Scotts Company LLC on March 9, 2012, and currently stayed. The patent at issue in this appeal, U.S. Patent No. 6,209,259, is also the subject of the pending litigation (currently stayed with respect to U.S. Patent No. 6,209,259), styled *Encap, LLC v. The Scotts Company LLC et al.*, Case No. 1:11-cv-000685 (E.D. Wis.), filed July 18, 2011. In addition, U.S. Patent No. 8,904,704 is a divisional patent of U.S. Patent No. 6,209,259, and is the subject of the pending litigation styled *Encap, LLC v. The Scotts Miracle-Gro Company, LLC, et al.*, Case No. 1:14-cv-01532 (E.D. Wis.), filed December 9, 2014. Those proceedings may be directly affected by this Court's decision in the pending appeal.

JURISDICTIONAL STATEMENT

This appeal rises from an *Inter Partes* Review before the Patent Trial and Appeal Board under 35 U.S.C. § 311 *et seq*. The Board entered a Final Written Decision on June 24, 2014, and the judgment or order appealed from is final. On August 21, 2014, Patent Owner Encap, LLC filed a timely notice of appeal. A3587-89. This Court has jurisdiction under 28 U.S.C. § 1295(a)(4)(A) and 35 U.S.C. § 319.

STATEMENT OF THE ISSUES

Issue 1. Did the Board erroneously conclude that all challenged claims of the '259 patent were obvious over Roth and Lowe when its conclusion relied on interpretations of Lowe not supported by substantial evidence and, in fact, contrary to the evidence.

Issue 2. Did the Board erroneously conclude that all challenged claims of the '259 patent were obvious over Roth and Lowe when its conclusion that one of ordinary skill in the art would combine Roth and Lowe was based only on hindsight and conjecture.

Issue 3. Did the Board erroneously conclude that claims 1, 2, 7, 8, 13, and 14 of the '259 patent were anticipated by Matthews when its conclusion relied on interpretations of Matthews not supported by substantial evidence and, in fact, contrary to the evidence.

Issue 4. Did the Board erroneously rule all claims of the '259 patent unpatentable, when all grounds relied on erroneous constructions of the terms "combination seed capsule" and "soil conditioning material."

Issue 5. Did the Board erroneously deny Encap's motion to amend, when Encap's motion satisfied all requirements established by the America Invents Act and the PTO's own implementing regulations.

STATEMENT OF THE CASE

I. Encap's '259 Patent and the Encapsulated Grass Seed Market

U.S. Patent No. 6,209,259 ("the '259 patent"), titled Seeding Treatments, issued on April 3, 2001 and is assigned to Appellant Encap, LLC ("Encap"). A0078-A0097. The object of the invention is to "provide solid plant seed capsule products that supply both soil conditioning properties and the seed, which benefits from such conditioned soil, in a given seed capsule product." A0086 at 3:28-31. The invention is further directed to "combination seed capsules" that "provide cooperative and beneficial effects of the soil conditioner . . ., working together in controlled intimate relation with the seed, to enhance the germination and growth processes of the seed, and the plant emergent therefrom, greater than when the soil conditioner and seed are applied to the soil separately; the improvement being a result of the intimate relationship of the respective materials in the "combination seed capsule," whereby the respective materials cooperate with each other in support of germination and plant growth." A0078 at Abstract.

Encap is a Wisconsin corporation that researches, develops, manufactures, markets and sells products in the consumer and commercial lawn and garden industry. A0787, A0791. Encap continues to invent and patent many novel platform technologies involving seed, mulch, water management, soil conditioners and fertilizer products (and combinations thereof). A0791. Encap expended

millions of dollars in research and development and legal costs to develop and protect its efforts. *Id*. One such patented invention owned by Encap is the ’259 patent at issue here. A0790, A0078-A0097.

In 2002, not long after the ’259 patent issued, Scotts contacted Encap, inquiring about Encap’s platform technologies and whether they were protected by any patents. A0791. In particular, Scotts was interested to know how the seed coating in Encap’s encapsulated seed technology absorbed water. *Id*. At Scotts’ request, Encap sent representative samples of Encap’s Grass Repair Kit and Encap’s mulch and encapsulated seed products to Scotts for testing. A0792.

After entering into a confidentiality agreement with Scotts, Encap disclosed additional information about the problems and shortcomings related to the current product technologies offered at the time, and how Encap’s platform technologies and products were developed to be a novel and innovative solution to these problems. A0792- 95. One such innovative platform technology discussed was the process that allows Encap to encapsulate individual seeds with the precise amount of nutrients, conditioners, and mulch required to enhance the seeds’ ability to survive and thrive. A0793. Scotts was informed at the time that this technology was patented by the ’259 patent. *Id.*

Shortly after these disclosures and without explanation, Scotts ceased communications with Encap and its representatives. A0799. However, as Scott’s

path of seed genetics and biotechnology began to present sizable delays and questions, Scotts re-focused and re-tooled its seed-focused marketing and product development strategy to replicate Encap's technologies. The innovative, revolutionary, and industry-changing patented technology that Encap designed to meet the yet unsatisfied consumer needs for seeds, as presented to Scotts in 2002, now became the unauthorized adopted child of innovation for Scotts for its specialty seed marketing and business strategies. Indeed, the building blocks for success that were conveyed by Encap to Scotts were cornerstone for the eventual industry-changing success of Scotts in the specialty seed market.

In 2009, Scotts first sold the coated Turf Builder Grass Seed with Water Smart®—products incorporating the technology presented in Encap's'259 patent. A0576-0577.

II. Course of the Proceedings

Faced with this infringement from a dominant market player, and after numerous attempts to find common ground with Scotts between 2002 and 2010, Encap sued Scotts for infringement of the '259 patent and two other patents on July 18, 2011, in the litigation styled *Encap, LLC v. The Scotts Company LLC, The Scotts Miracle-Gro Company and OMS Investments, Inc.*, Case No. 1:11-cv-000685-WCG (E.D. Wis.). Later, on March 9, 2012, Scotts filed an *ex parte* reexamination for the '259 patent that was assigned Control No. 90/012,183.

A0704-05. Based on this and other reexaminations, Scotts sought a stay of the litigation, which the district court granted on August 31, 2012. A0499. The district court has continued this stay with respect to the ’259 patent.

The *ex parte* reexamination of the ’259 patent proceeded to an office action on December 21, 2012. A0450. At about the same time, Scotts petitioned for an *inter partes* review of the ’259 patent. A0101-64. Despite the advanced stage of the *ex parte* reexamination proceeding, and over Encap’s objection, the Patent Trial and Appeal Board (“the Board”) stayed the *ex parte* reexamination on May 13, 2013. A0868-70. On July 3, 2013, the Board initiated *inter partes* review of the ’259 patent on six of the eight different grounds advanced by Scotts. A0875-93.

Encap submitted its response to the petition on September 13, 2013, together with a contingent motion to amend. These filings were later expunged from the record and replaced with corrected versions to address issues related to consistent labeling of exhibits. A1200-71; A3421-28; A3477-78.

Encap’s motion to amend was straight-forward. It proposed substitute claims 15-24, should the original claims be found not patentable, to expressly incorporate into the claims the claim constructions that Encap proposed. A1215. In other words, Encap believed that its proposed constructions reflected the correct broadest reasonable interpretations and distinguished over the prior art. But if the Board disagreed the solution was simple: the claims would be replaced with substitute

claims to incorporate the proposed constructions expressly. Scotts filed a reply to Encap's response on November 19, 2013. A0953-69.

Scotts' response to Encap's motion to amend asserted that Encap had not complied with the Board's procedural requirements or the Board's substantive standard imposing on Encap the burden of establishing patentability of the proposed substitute claims. A0956-59. It did not however, assert that the substitute claims were, in fact, not patentable over any particular prior art or combination, but instead used a scattershot approach in an incorporated claim chart to address the claims vis a vis randomly selected prior art references. A0951-69.

The Board conducted a hearing on January 30, 2014.

On June 24, 2014, the Board issued its Final Written Decision. A0001-35. The decision determined that Scotts had shown by a preponderance of the evidence that:

(1) claims 1, 7, and 13 of the '259 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 3,698,133 to Schreiber ("Schreiber");

(2) claims 1, 2, 7, 8, 13, and 14 are unpatentable under 35 U.S.C. § 102(b) as anticipated by UK Patent No. GB670,461 to Matthews ("Matthews"); and

(3) claims 1-5, 7-11, 13, and 14 are unpatentable under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 4,065,287 to Roth ("Roth") and U.S. Patent No. 4,065,287 to Lowe ("Lowe").

A0034. The decision further found that Scotts had not established invalidity of these same claims on three different grounds. *Id.*

Because the Board ruled the challenged claims to be unpatentable, it also considered Encap's motion to amend. A0029. The Board, relying on Board precedent, ruled that Encap bore the burden to "demonstrate[] the patentability of those substitute claims." *Id.* It denied the motion to amend, finding that "Encap has failed to demonstrate that the added limitations distinguish over the known prior art, for example, Roth in combination with Lowe." *Id.*

On August 21, 2014, Encap filed its timely notice of appeal. A3587-89. Scotts did not appeal from the Board's decision. This appeal followed.

SUMMARY OF THE ARGUMENT

The role of the Board in an *inter partes* review should be to act as a neutral adjudicator evaluating the evidence presented by the petitioner in the context of an adversarial proceeding. The Board does not sit as a meta-Examiner, looking for reasons to cancel the claims of issued patents and substituting the opinions and speculations of the panel for the petitioner's obligation to provide evidence of invalidity. That, unfortunately, is what happened here. In ruling the challenged claims of Encap's '259 patent to be unpatentable, the Board repeatedly misconstrued the evidence presented by Scotts, substituted its own speculation for deficiencies in Scotts' case, and shifted the burden of proof inappropriately to Encap.

Moreover, much of the entire proceeding was a waste of resources of both the Board and the parties. Faced with the petition, Encap was prepared to substitute the original claims with new claims amended to more precisely claim the subject matter and distinguish the prior art, removing the need for complicated claim construction and avoiding the need for debates about the disclosures of the prior art references. But while the America Invents Act calls for *inter partes* review procedures to allow for claim amendments, the Board's precedent applied in this case not only discourages amendments but makes such amendments virtually impossible.

The Board should have affirmed the claims of the '259 patent or else allowed Encap to substitute amended claims to address the grounds raised in the proceeding. The Board committed several errors in reaching the opposite result.

First, in support of its conclusion that the challenged claims were obvious in view of Roth and Lowe, the Board committed critical factual errors in its consideration of the Lowe reference. Although Lowe makes ***no*** disclosure or suggestion regarding seeds ***or*** coatings, the Board nonetheless concluded that "Lowe discloses coating a seed." A0019. And while the evidence presented by Encap showed that Lowe's paper mill sludge did not act as the claimed "soil conditioning material" under the Board's own construction, the Board improperly assumed that it did so (despite expert testimony to the contrary) and improperly placed the burden on Encap to prove that it could not. The Board also improperly relied on the characteristics of Roth's coating agent (a black pudding-like substance called MAS) that the Board ***excluded*** when it substituted Lowe's paper sludge material for Roth's pudding-like MAS coating agent, to support its conclusion that the combination disclosed certain limitations in several dependent claims.

Second, the Board's conclusions about reasons to combine Roth and Lowe are based on hindsight and conjecture and are contrary to the expert testimony. Despite Encap's evidence showing that Lowe's solid paper mill sludge could ***not***

be substituted for Roth's black pudding-like MAS substance in an operable manner, the Board "presumed" they could be and again improperly put the burden on Encap to prove that it could not.

Third, the Board's anticipation rejections based on Matthews rely on the same erroneous consideration of the "soil conditioning material" as did its obviousness rejection, even under its own construction. Matthews does not disclose any material that functions to "***beneficially modify*** soil" to which it is applied (as required by the Board's own construction), either expressly or inherently. The Board improperly (and contrary to its own claim construction ruling) based its conclusion merely on the fact that fly ash and lime were identified in the '259 patent as potential exemplary categories, and erred in placing on Encap the burden of showing that the limitation was not met.

Fourth, all of the Board's patentability rulings rely on incorrect claim construction rulings for "combination seed capsule" and "soil conditioning material." The Board ruled that "combination seed capsule" was not limiting and need not be construed. Although this language appears in the preamble of the claims, the body of the claims and the specification dictate that the term be construed as limiting. The Board's construction of "soil conditioning material" was incomplete because it adopted only half of the definitional paragraph in the

specification. Under either correct construction, there is no dispute that all of the asserted grounds fail.

Fifth, to the extent that all of the challenged claims were found anticipated or obvious, the Board should have granted Encap's motion to amend. Encap's motion presented substitute claims that incorporated its proposed claim constructions into the claims themselves. The amendments responded to the grounds of the cancellation, and fully complied with the statutory and regulatory standards. The Board's precedent imposing *ultra vires* substantive and procedural requirements cannot be sustained, and its application of that precedent in this case was legal error.

ARGUMENT

I. Standard of Review

"The Patent and Trademark Office . . . is governed by the Administrative Procedure Act ('APA'), and PTO decisions are reviewed under the APA standard." *In re Chapman*, 595 F.3d 1330, 1336-37 (Fed. Cir. 2010). This Court must "hold unlawful and set aside any agency action, findings, and conclusions found to be – (A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law; . . . (C) in excess of statutory jurisdiction, authority, or limitations, or short of statutory right; (D) without observance of procedure required by law; [or] (E) unsupported by substantial evidence." 5 U.S.C. § 706(2). In applying the APA standard, the Board's claim construction is reviewed *de novo*. *In re Baker Hughes Inc.*, 215 F.3d 1297, 1301 (Fed. Cir. 2000). "The Board's legal conclusion of obviousness is reviewed *de novo*," and its factual determinations in the obviousness analysis are reviewed for substantial evidence." *In re Gartside*, 203 F.3d 1305, 1316 (Fed. Cir. 2000).

Scotts bears the burden of proof to establish that it is entitled to its requested relief of a determination that each of the challenged claims—claims 1-5, 7-11, and 13-14—is unpatentable. 35 U.S.C. § 316(e).

II. The Board's Obviousness Rulings Rely on Erroneous Interpretations of Lowe

The Board ruled all challenged claims of the '259 patent as obvious over Roth and Lowe. A0018-21. Its conclusion, however, relied on at least three erroneous interpretations of Lowe, each of which provide an independent basis to reverse the Board's rulings.

A. Lowe Does Not Disclose or Suggest Either a "Coating" or "Seeds"

The Board's obviousness rulings relied on its conclusion that Roth discloses all limitations of independent claims 1 and 7 except for the requirement that the recited "soil conditioning materials" be "in a solid state at the time of coating." A0019. To fill this gap, the Board looked to Lowe and determined that "***Lowe discloses coating a seed*** with de-inked paper sludge having a 'fiber content of the solids in the mixture should exceed at least 10%-15% by weight,' thereby teaching 'in a solid state at the time of coating.'" A0019 (emphasis added), citing A0184 at 3: 17-21.

This determination, however, is blatantly incorrect. Lowe discloses ***only*** the formation of pellets or granules of uniform composition, without any reference to seeds or coatings. A0184 at 3:25-26 ("The sludge and slurry mixture is formed into spherical pellets or, preferably, granule shapes."). Lowe does not disclose or suggest that its sludge and slurry mixture is used or could be used as a coating for ***anything***, and the words "coat" or "coating" do ***not*** appear anywhere in Lowe.

Further, Lowe makes ***absolutely no reference*** to a seed—the word "seed" appears nowhere in Lowe. Nor is there any disclosure of any sort of core or nucleus. Thus, while Lowe discloses a mixture including paper sludge where "the fiber content of the solids in the mixture should exceed at least 10%-15% by weight," the Board's ***express finding*** that Lowe discloses that this mixture is or can be used for "coating a seed" cannot be supported by substantial evidence when Lowe is silent as to both "coating" and "seeds." Scotts did not, in fact, argue or offer evidence that Lowe disclosed coating a seed, asserting merely that it disclosed "paper sludge as an effective fertilizer carrier." A0161. Thus, Lowe ***cannot*** teach the recited "in a solid state at the time of coating" since it does not suggest a "coating" or "seeds" and, therefore, Scotts failed to meet its burden.

Moreover, the Board ignored Encap's evidence from one of skill in the art of the patent that Lowe did not disclose a mixture, process, or binder that ***could*** be used to coat a seed. Encap's evidence, namely the declaration of inventor Daniel Madigan, showed a photograph of a demonstration illustrating the adverse results should grass seed be introduced into the agglomeration process of Lowe. A1013, A1029. Mr. Madigan further explained that "the paper mill sludge agglomerated, but ***not around the seed***." A1013 (emphasis added). Thus, the testing showed that a seed ***would not and could not*** act as "a core" (as required by the '259 patent) in the Lowe process and with Lowe's paper sludge material. This is because in the

seed coating industry, specific materials are used, in specific conditions, and in specific quantities, with specific processes, to accomplish specific functions. Scotts' reply did not even address or rebut this evidence. A0924-42.

Because Lowe—with no reference to any "seed" or "coating"—cannot teach this limitation, and because Encap's evidence showed that it was not possible to coat grass seed with paper sludge within the teachings of Lowe, it follows that the Board's obviousness rulings must be reversed. Identification in the prior art of all the limitations of the claim is necessary (but not itself sufficient) to establish obviousness. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1164 (Fed. Cir. 2006) (stating that the Court considers motivation to combine and reasonable expectation of success only "if all the elements of an invention are found in a combination of prior art references"); *see also In re Kahn*, 441 F.3d 977, 986 (Fed. Cir. 2006); *In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995). This Court should rule that Scotts has not met its burden of showing obviousness of any claim, and reverse all of the Board's obviousness rulings.

B. Lowe Does Not Disclose or Suggest a "Soil Conditioning Material" as Defined by the Board

The Board's obviousness rulings also should be reversed because the Board improperly concluded that Lowe discloses the claimed "soil conditioning material" as defined by the Board's own construction. As the Board observed, "[a]ll of the challenged claims require 'a coating of a composition comprising soil conditioning

materials.'" A0009. In its Final Written Decision, the Board maintained the construction it adopted in its initiation decision:

> Materials that ***beneficially modify*** soil to which they are applied, in some way other than direct provision of nitrogen, phosphorus, and/or potassium or other plant nutrients, including for example, municipal or other sewage sludge, paper mill sludge, fly ash, and dust.

A0011 (emphasis added).

The Board's construction properly recognized that, in the broad field of treated or coated seeds, specific materials must be used in specific quantities, in a specific state, applied in a specific way, to accomplish a specific function. The ability of any particular material to beneficially modify the soil when coated on a seed may not be assumed, but relies on the specifics of the total application.

1. Lowe Does Not Expressly Disclose Paper Mill Sludge as a "Soil Conditioning Material"

The Board's obviousness combination of Roth and Lowe relies on Lowe's paper mill sludge to be the claimed coating (A0019), which the claims all require to comprise "soil conditioning materials." Lowe, however, does not disclose or suggest that its paper mill sludge meets the Board's construction, as Encap explained to the Board. A1267-68, A2202. Lowe's paper mill sludge is used only as a ***carrier*** or ***diluent*** for pesticides or fertilizer. A0183 at 1:11-14. Just because a carrier is applied to the ground for one function (*i.e.*, as a carrier) does not necessarily mean it is included in the form, quantity and manner to perform a

different function. The paper mill sludge of Lowe does not itself beneficially modify the soil to which it is applied, and by design is meant to be chemically inert. *Id*. at 1:24, 2:4. Thus, Lowe does not expressly disclose that its paper mill sludge is the claimed "soil conditioning material."

2. Lowe Does Not Inherently Disclose Paper Mill Sludge as a "Soil Conditioning Material"

Moreover, Lowe does not inherently disclose the "soil conditioning material" limitation. The inherent teaching of a prior art reference is a question of fact. *In re Napier*, 55 F.3d 610, 613 (Fed. Cir. 1995). And inherent disclosure requires that the limitation be "necessarily present" in the prior art reference. *Allergan, Inc. v. Apotex Inc.*, 754 F. 3d 952, 958 (Fed. Cir. 2014). This Court has recognized that inherency may supply a missing claim limitation in an obviousness analysis. *Par Pharm., Inc. v. TWI Pharms., Inc.*, __ F.3d __, No. 2014-1391, slip op. at 14 (Fed. Cir. Dec. 3, 2014) (*citing*, *e.g.*, *Santarus*, *Inc. v. Par Pharm., Inc.*, 694 F.3d 1344, 1354 (Fed. Cir. 2012)). However, this Court also has "explained that the use of inherency, a doctrine originally rooted in anticipation, must be carefully circumscribed in the context of obviousness." *Par Pharm.*, slip op at 14. The Board's rulings, accordingly, "must meet a high standard in order to rely on inherency to establish the existence of a claim limitation in the prior art in an obviousness analysis—the limitation at issue necessarily must be present, or the

natural result of the combination of elements explicitly disclosed by the prior art." *Par Pharm.*, slip op at 16.

Scotts, however, offered no evidence supporting the Board's conclusion that Lowe's paper mill sludge ***necessarily*** beneficially modified the soil. A0161. And Encap's unrebutted evidence established that it did ***not necessarily*** beneficially modify the soil. In particular, Encap presented evidence from one of skill in the art confirming that "[n]ot all paper sludge materials are created equal," and so "[n]ot all paper sludge material would benefit the soil to which it is applied, whereas some paper sludge material may harm the soil to which it is applied." A2202 at ¶19. Even Scotts' expert Dr. Sundstrom recognized that a paper mill sludge would need to provide this function in order to meet the "soil conditioning material" limitation of the claims. A3049 at 73:6-13.

At its core, the Board relied on the assumption that all paper mill sludge necessarily met the limitation because paper sludge was included as an example "soil conditioning material" in the patent and included as examples in the Board's construction. This is unsupported as a factual matter, as Encap's evidence showed that paper sludge in general, and the paper sludge disclosed in Lowe in particular, would not necessarily beneficially modify the soil. A1267-68, A2202.

It also is inconsistent with the Board's ***own*** claim construction. With respect to claim construction of "soil conditioning material," Encap argued to the Board

that "the examples included in the Board's preliminary claim construction should be omitted, because not all municipal or other sewage sludge, paper mill sludge, fly ash, or dust necessarily modify the soil in a beneficial manner." A0011. In response, the Board observed that its claim construction required that the material modify the soil, and explained that the "inclusion of the examples is intended to clarify, not modify, this requirement." *Id*.

The Board's obviousness rulings, however, ***did*** modify the requirement, concluding in essence that Scotts need not establish or offer evidence that Lowe's paper mill sludge expressly disclosed or inherently modified the soil in a beneficial matter, so long as the asserted coating material was listed as an example. A019. Neither the Board nor Scotts pointed to any justification beyond that.

Despite the fact that Scotts bore the burden on inherency, Encap presented evidence from persons of ordinary skill in the art against inherency, and Scotts presented only attorney argument for inherency. The Board then dismissed Encap's evidence, concluding that it did "not support Encap's contention" because Encap's supporting declaration established merely that "'[n]ot all paper sludge material would benefit the soil to which it is applied'" and did "not state that Lowe's paper sludge is not beneficial to the soil." A0021. First, this is legal error because the burden is not on Encap to prove that the reference does ***not disclose*** the limitation. Rather, it is Scotts burden to establish, for starters, that all the limitations ***are***

disclosed in the asserted combination. Second, the Board's analysis shows that its rulings were incorrect. The Board itself recognized that Encap's evidence showed that "'[n]ot all paper sludge material would benefit the soil to which it is applied.'" A0021 (citing A2202). This, however, negates the Board's inherency finding because it establishes that Scotts could ***not*** show that "the limitation at issue necessarily must be present, or the natural result of the combination of elements explicitly disclosed by the prior art." *Par Pharm*., slip op at 16.

3. Roth's Pudding-Like MAS Cannot be the "Soil Conditioning Material" in the Asserted Combination

Nor can Scotts and the Board rely on the Board's conclusion that Roth's coating of methanol treated activated sewage sludge ("MAS") (A0018-19) meets the "soil conditioning material" limitation. In the obviousness combination on which the Board relies, Lowe's paper mill sludge is substituted for Roth's MAS. A0019. Thus, the question of whether Roth's MAS is or is not a "soil conditioning material" is irrelevant to the question of whether a proposed combination ***substituting*** paper mill sludge for MAS discloses the limitation. Further, because Roth's MAS has been substituted ***out*** of the combination allegedly rendering independent claims 1 and 7 obvious, the Board committed legal error in relying on this teaching to meet limitations in claims 2, 5, 8, and 11 expressly requiring that the source material be municipal sewage. A0018.

Because the Board's combination of Roth and Lowe does not disclose the "soil conditioning material" limitation under the Board's own construction, this Court should rule that Scotts has not met its burden of showing obviousness of any claim, and reverse all of the Board's obviousness rulings.

C. Lowe Does Not Disclose or Suggest a "Binder"

Finally, the Board erroneously concluded that the combination of Roth and Lowe discloses the claimed "binder applied to said seed capsule" recited in claim 13. In support of its ruling, the Board concluded that "Roth also discloses that its coating may include a 'binder,' *e.g.*, polyvinyl alcohol, starch derivatives." A0018. But in the obviousness combination on which the Board relies, Roth's coating is ***replaced*** with Lowe's paper mill sludge. A0019. Whether Roth's coating may include a binder cannot establish that a proposed combination ***substituting*** Lowe's paper mill sludge for Roth's coating discloses the limitation. What must be considered is the asserted combination, not snippets of the individual references that are left out of the combination. Lowe, moreover, expressly teaches that ***its*** paper mill sludge mixture intentionally "lack[s] . . . a separate binder." A0184 at 3:17. Thus, for this reason this Court should reverse the Board's obviousness rulings of claim 13 and its dependent claim 14.

III. The Board's Obviousness Rulings Rely on Unsupported Speculation to Combine Roth and Lowe

Even if the combination of Roth and Lowe disclosed all of the claim limitations of any challenged claim, which it does not, the Board's obviousness rulings still must be reversed because there is no substantial evidence supporting combination. An obviousness determination cannot be based on picking and choosing specific disclosures with the aid of hindsight to arrive at the challenged claims as a whole. *Ecolochem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1371 (Fed. Cir. 2000) (one "cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention") (quoting *In re Fine*, 837 F.2d 1071, 1075 (Fed. Cir 1988)); *Kahn*, 441 F.3d at 986 ("mere identification in the prior art of each element is insufficient to defeat the patentability of the combined subject matter as a whole").

The Board's combination analysis presents a classic situation of hindsight reconstruction, based on erroneous factual conclusions and blatant speculation. First, the Board concluded that the Roth/Lowe combination "involves the use of known components for their known purpose to achieve a predictable result." A0019. But this ruling rests on the factually erroneous conclusion that "Lowe discloses coating a seed with a de-inked paper sludge." *Id*. Lowe discloses nothing of the sort—as discussed above, it discloses neither coatings nor seeds. Nor does Lowe discuss any sort or core or nucleus. There is simply no evidence supporting

the Board's conclusion that the paper mill sludge of Lowe is being used in combination for its ***known*** purpose to achieve a ***predictable*** result. To the contrary, this reflects improper use of the '259 patent itself as a roadmap, as it is the '259 patent—and not the prior art—that teaches using paper mill sludge for the purpose and result claimed in the '259 patent.

The fact that both Roth and Lowe involve "agricultural" applications cannot create a reason to combine the references such that "a person of ordinary skill in the art would have had reason to substitute Lowe's paper mill sludge for Roth's MAS coating," as the Board asserts. A0019. Scotts assertion in the petition that "[i]t would . . . have been obvious to utilize the paper mill sludge of Lowe as the coating material of Roth, as Lowe discloses paper sludge as an effective fertilizer carrier" (A061) is speculative and conclusory, and not supported by evidence. Whether or not Lowe discloses that paper mill sludge is a fertilizer carrier has no relation to and does not support substituting Lowe's paper mill sludge for Roth's pudding-like MAS coating. Scotts bore the burden of establishing the substitution of Lowe's paper mill sludge for Roth's MAS, and offers no justification for doing so beyond the improper attorney-argument approach of using "hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *Ecolochem,* 227 F.3d at 1371.

Further, the Board improperly set aside Encap's evidence that the alleged combination could not support an obviousness combination because it would not work for its intended purpose. In most simple terms, it is nonsensical to assume with no factual support that applications of a liquid can be used for dry solids, or to substitute the dry paper mill sludge solid disclosed in Lowe for the pudding-like MAS coating material disclosed in Roth when coating a seed with materials in such a specific manner to accomplish a function when coated about a seed. Roth describes MAS as "a viscous, black, polymeric pudding" (A0175 at 6:52-53), having a solids content of 0.1-2.5% (A0174 at 3:45-51.) *See also* A0979-80.

Encap's evidence established not only that Lowe's material could not be sprayed, but that this dry solid material was not viable as a seed coating at all. A1012-13; A1263-66. As inventor Daniel Madigan explained: "Wherein the black pudding like substance of MAS, as taught by Roth and that of Davis/Wallen, was found to be an excellent material for forming this, continuous films that serve as a slow release mechanism for chemicals, the de-inked paper sludge of Lowe containing 40-50% solids stand starkly different in form and structure. Therefore one of ordinary skill at the time of the '259 invention would not know to use the paper sludge material of Lowe as a substitute for the black tar-like substance of Roth's MAS." A1012 at ¶ 20; *see also* A1012-13 at ¶22.

Mr. Madigan also explained that the "final product of Roth coats seed with MAS by dipping, coating and/or spraying the MAS onto the seed . . . [while, in contrast], the final product of Lowe does not include seed, or any other material, to act as a nucleating agent." A1013 at ¶ 23. Thus, as Mr. Madigan explained and demonstrated with photographic evidence (A1029), the result of introducing a seed into the Lowe's mixture and process "is that the paper mill sludge is agglomerated, but not around the seed." *Id*. Thus, one of ordinary skill "would not have reason to substitute Lowe's paper mill sludge for Roth's MAS coating because one requires seed to act as a core, and the other pays no consideration to such requirement." *Id*. Scotts did not address or rebut this evidence showing that a seed would ***not*** act as a core in Lowe wherein the solid material could be built about the seed to form a coated seed product. A0924-42.

The Board summarily concluded that "[w]e do not credit Mr. Madigan's declaration as it fails to provide the underlying basis for his conclusions." A0020. But the declaration did explain the bases, with supporting comparative photographs, including his assessment of Lowe and Roth, and the results of failed tests incorporating grass seeds into the Lowe paper mill sludge agglomeration. A1011-14. The Board's rejection of this evidence reflects its desire to override Encap's expert evidence with its own thoughts, even when the evidence conflicted with the Board's own unsupported conclusions about Lowe. Regardless, it was

Scott's burden to establish obviousness based on evidence, ***not*** Encap's burden to introduce evidence to refute Scotts and the Board's erroneous conclusions.

In sum, the Board improperly substituted its own view of the art for Encap's evidence from one of skill in the art, concluding that the pudding-like "MAS, and ***presumably*** Lowe's paper sludge, can be applied to the seeds 'by dipping, soaking, spraying, or any other conventional mode of application.'" A0020 (emphasis added). But again Scotts bore the burden of making this showing, and failed to do so. The Board cannot fill holes in Scotts' obviousness case by ***presuming*** the physical properties and performance of a paper sludge (as shown in the Madigan Declaration) are the same as those of the black pudding-like MAS substance. In truth, there is nothing similar between them. Doing so is especially egregious when it conflicts with the evidence that Encap did introduce. The Board's criticism that Mr. Madigan's demonstration used Lowe's paper sludge but only Lowe's agglomeration process (A0021) misses the mark: the testing showed that a seed would not act as a nucleus (which is much more complex and difficult than the mere joining together without a seed acting as a nucleus) with Lowe's paper sludge, and Scotts provided no evidence suggesting that using "dipping, soaking, spraying, or any other conventional mode of application" would change this, of that those processes were even workable to try for paper sludge material.

For this additional and independent reason, this Court should rule that Scotts has not met its burden of showing obviousness of any claim, and reverse all of the Board's obviousness rulings.

IV. The Board's Rulings of Anticipation by Matthews Rely on the Erroneous Conclusion that Matthews Discloses a "Soil Conditioning Material" as Defined by the Board

Mirroring its erroneous assessment of the Lowe reference in the context of its obviousness rulings, the Board also erroneously determined that Matthews disclosed the claimed "soil conditioning material" as construed by the Board in ruling claims 1, 2, 7, 8, 13, and 14 to be anticipated. The Board and Scotts identified "fly ash" disclosed in Matthews as meeting this claim limitation. A0026; A0158-60.

As it did with Lowe, the Board ignored a key portion of its own claim construction for "soil conditioning material." Despite its ruling that its claim construction ***required*** that the specifically identified "soil conditioning materials" must "beneficially modify soil to which they are applied," and further explained that the "inclusion of the examples is intended to clarify, not modify, this requirement" (A0011), the Board's analysis shows that it found Matthews to disclose this limitation despite the absence of either an express or inherent disclosure of a coating that ***beneficially modifies the soil***.

A. Matthews Does Not Expressly Disclose Fly Ash as a "Soil Conditioning Material"

First, there is no express disclosure that Matthews' fly ash itself beneficially modifies the soil. Matthews discloses that a seed is first coated with an adhesive, such as polyvinyl alcohol, and then fly ash is "dusted" over the seed to coat it. A0206 at 2:41-65. This coating is for mechanical protection of the seed—***not to beneficially modify the soil*** as is claimed in the '259 patent. A1061-63; A2600-01. Matthews' fly ash is used together with a water soluble plastic to "coat . . . seeds and produce seed pellets of uniform size, hardness, and germination characteristics." A206 at 2:47-49. "These seed pellets consist of a relatively uniform coating of impacted dust particles bound by an adhesive water-soluble plastic around and about the original seed particle as a nucleus." *Id*. at 2:50-54. "The particular dust materials which have been found to give very satisfactory results are fly-ash, feldspar, and acid-activated earth." *Id*. at 2:61-65. The purpose of the layered coating of plastic and dust is create "pellets of such magnitude, hardness, and uniformity of size as to be adapted for handling in mechanical devices without crushing of the pellet or jamming and plugging of the planter." *Id.* at 2:4-9. Therefore, the type of coating material specifically selected and used by Matthews, *i.e.*, fly ash, is a specific material, used in a specific quantity, and in specific form, size, and shape, and coated in a specific manner, for the defined purpose of handling in mechanical devices without crushing the seed pellets or

jamming and plugging the planter, a point recognized by Scotts' expert Dr. Sundstrom. A3043 at 48:13-21.

Matthews' coating is designed, "on contact with soil moisture, to crumble and break down readily so as to ***permit*** germination of the seed and emergence of the sprout." A206 at 2:29-28. While, to be sure, the residual "dust" remains in the soil, Matthews does not teach or suggest that the ***dust*** of Matthews "beneficially modif[ies] soil to which [it is] applied," as the Board's construction requires.

The Board asserts that "Matthews also discloses that the use of its coating materials 'aid in germination' and 'growth of the plant.'" A0026, citing A0206 at 2:33-39. But this finding plainly misstates the disclosure. What Matthews actually discloses is that various ***additives*** "may be incorporated with the coating of the seed" to provide these benefits, ***not*** that the fly ash or other dust provides these benefits. A0206 at 2:36-37. Therefore, the Board erred in its conclusion and/or assumption that the fly ash provided the required beneficial modification to the soil.

B. Matthews Does Not Inherently Disclose Fly Ash as a "Soil Conditioning Material"

Nor is it inherent that the disclosed fly ash "dust" beneficially modifies the soil to which it is applied. While Scotts bore the burden of proof to establish that the limitation was present, Scotts simply provided attorney argument that "Matthews teaches that 'fly ash' is a dust material that gave very satisfactory

results," that "[c]laims 2 and 8 of the '259 patent recite that the soil conditioning material comprises 'fly ash,'" and that, *ipse dixit*, "[a]ccordingly, Matthews teaches a 'soil conditioning material." A0158. Encap provided declarations from persons of ordinary skill in the art, however, that established that ***not all fly ash would necessarily*** beneficially modify the soil and, in particular, Matthews' fly ash did not necessarily ***beneficially modify the soil***. A2598-2602; A1062-64; A2202-04. Even Scotts' expert Dr. Sundstrom recognized that a fly ash would need to provide this function in order to meet the "soil conditioning material" limitation of the claims. A3049 at 73:14-21. Thus, mere disclosure of "fly ash" does not inherently disclose the '259 patent's claimed "soil conditioning material" and its required function, or its ability to provide the function, as used in Matthews.

The Board further asserted that its claim construction of "soil conditioning material" did not ***require*** that the soil conditioning material itself necessarily be beneficial to the soil. A0026. ("Encap unpersuasively asserts that Matthews' fly ash may not necessarily beneficial to the seed—a requirement lacking from our claim construction of 'soil conditioning material.'"). This is nonsensical and contrary to the Board's own construction that "soil conditioning materials" are "materials that beneficially modify the soil to which they are applied . . . ." A0011. The Board further ruled that this ***"requirement"*** is ***not modified*** by the listed examples (which include fly ash). *Id*. To disclose the claimed limitation, Matthews

must either expressly disclose that its fly ash beneficially modifies the soil, which it does not, or else Scotts must establish that Matthew's fly ash necessarily beneficially modifies the soil and so discloses the limitation inherently. *Allergan*, 754 F. 3d at 958. While the Board looked to Matthews' teaching that its fly ash material should be "non-toxic," it ignored the fact that there is no evidence suggesting that all non-toxic fly ash ***necessarily beneficially modifies the soil***, and ignored Encap's evidence from persons of ordinary skill demonstrating that it does ***not***. *See, e.g.,* A2203 ("Given not all fly ash materials are used as soil conditioners, one of ordinary skill in the art reading the Matthews patent prior to the Madigan invention would not utilize fly ash as a soil conditioning material, as it's defined in the Madigan patent.").

The Board also erroneously relied on mischaracterized testimony of Encap's expert Dr. Baker suggesting that "a person of ordinary skill would have understood that a non-toxic fly ash ***could*** be used to coat a seed as a soil condition material" and its determination that "a person of ordinary skill would ***interpret*** Matthews as using a non-toxic fly ash, beneficial to the soil." A0026 (emphasis added) (citing A2178, l.18 – A2179, l.20). Dr. Baker, Encap's expert witness, clearly testified that Matthews itself did not address the toxicity of the disclosed fly ash. A2178, ll.16-17. His testimony related not to Matthews' disclosure, but rather to his opinions on the knowledge of one of skill in the art. A2178, l.25 – A2179, l.20.

Scotts' asserted ground and the Board's rulings are based on anticipation and not obviousness. The Board erred in not finding that each limitation must be disclosed explicitly or inherently, and what the reference might otherwise suggest to a person of ordinary skill as possible or preferred is irrelevant. *In re NTP, Inc.*, 654 F. 3d 1279, 1301-02 (Fed. Cir. 2011).

C. Matthews Does Not Disclose Lime as a "Soil Conditioning Material"

Finally, the Board sought to buttress its ruling by concluding that Matthews "also discloses using lime," which "Mr. Krysiak admitted was a soil condition material." A0026. This fails on many levels. First, Matthews explicitly teaches that lime is ***not*** usable as a coating material. Specifically, Mathews teaches, "the importance of proper specific gravity for the mineral coating material" because "[s]pecific gravity of the individual particles is one of the critical factors in the method of building up cylindrical pellets of uniform size." A0213 at 9:82-88. Thus, Matthews explicitly teaches that "very light substances such as . . . lime . . . do not have proper rolling contact with their neighboring pellets . . . to give the desired formative effect." A0213 at 9:89-100. As previously discussed, the materials of Matthews are specifically selected for properties, and used in specific quantities, that directly affect their formative effects. Second, Scotts did not advance this "lime" theory. This is not an *ex parte* appeal where the Board is authorized to act as a meta-examiner and devise alternative bases for rejection. It is an *inter partes*

review, where the petitioner bears the burden. 35 U.S.C. § 316. Third, Mr. Krysiak's testimony that Matthews discloses using lime as a nutrient simply confirms that Matthew discloses that lime ***may*** be used as an ***additive*** to the coating that ***could*** have beneficial effects. A2002 at ll. 18-23. However, given the specific "formative effect" properties of materials required by Matthews, lime was indeed and expressly ruled out by Matthews.

Accordingly, this Court should rule that Scotts has not met its burden of showing anticipation of claims 1, 2, 7, 8, 13, and 14 by Matthews, and reverse the Board's anticipation rulings based on that ground.

V. All the Board's Patentability Rulings Rely on Erroneous Constructions of "Combination Seed Capsule" and "Soil Conditioning Material"

The Board also erroneously failed to construe the limitation "combination seed capsule" and reached an incomplete construction of the limitation "soil conditioning material." Under the correct constructions, all of the Board's patentability rulings should be reversed.

A. The Board Improperly Failed to Construe "Combination Seed Capsule"

Each of the Board's grounds for cancellation—obviousness over Roth and Lowe (A0021) and anticipation by Schreiber (A0022) and Matthews (A0025)—rely on its rejection of Encap's proposed construction of "combination seed capsule." Encap explained to the Board why each of these theories failed under its

proposed construction. A1267, A1238-44, A1258-61. In essence, whereas the seed capsule of Roth is one that is specifically designed to be a carrier and delivery system for agricultural chemicals by using a specific black pudding-like substance as a seed coating, and the seed capsule of Matthews is one that specifically is designed to create a coated seed designed to withstand the beating of planting equipment by using specific materials with specific formative effects in specific quantities, the claimed "combination seed capsule" of the '259 patent is one that specifically is designed to create a coated seed that includes a "soil conditioning material" in order to benefit the seed from the conditioned soil. Scotts did not dispute that each of these three asserted grounds of invalidity fail under Encap's proposal, choosing instead to argue the construction itself. A0924-40.

Here, the Board erred by ruling that the "combination seed capsule" recited in the preamble of both independent claims was not limiting, and by rejecting Encap's proposed construction. Indeed, Scotts conceded that the recited "combination seed capsule" constituted a limitation by requesting construction of this claim element in its Petition for Inter Partes Review. A0126.

Under a broadest reasonable interpretation, words of the claim must be given their plain meaning, unless such meaning is inconsistent with the specification. "The presumption that a term is given its ordinary and customary meaning may be rebutted by the applicant by clearly setting forth a different definition of the term in

the specification." *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997) (the PTO looks to the ordinary use of the claim terms taking into account definitions or other "enlightenment" contained in the written description). In other words, even a "broadest reasonable interpretation" cannot "ignore any interpretative guidance afforded by the applicant's written description." *Morris*, 127 F.3d at 1054. Here, the Board's construction of "combination seed capsule" is not ***reasonable*** and thus improper. *In re Buszard*, 504 F. 3d 1364, 1367 (Fed. Cir. 2007); *In re Baker Hughes Inc.*, 215 F. 3d 1297, 1301–04 (Fed. Cir. 2000).

The Board's principal error was its conclusion that the term "combination seed capsule" was not limiting because it is recited in the preamble of the independent claims. A0013 ("Thus, we need not construe 'combination seed capsule,' as it does not limit the claim."). The determination of whether preamble recitations are structural limitations can be resolved only on review of the entirety of the application "to gain an understanding of what the inventors actually invented and intended to encompass by the claim." *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1257 (Fed. Cir. 1989); *see also, e.g., Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 620 (Fed. Cir. 1995) ("[A] claim preamble has the import that the claim as a whole suggests for it."). This is consistent with the PTO's own guidance, which provides,

"The entire claim must be considered, including the preamble language and the transitional phrase." MPEP § 2163 (II)(A)(1).

Here, the Abstract of the '259 patent provides insight into the proper interpretation:

> each seed capsule includes both moieties of at least one soil conditioner and at least one seed, and optionally, one or more inorganic chemical fertilizer, growth enhancer, binder, and/or anti-fungal agent. The combination seed capsules are made by physically combining the respective soil conditioning material and seed with one other, in the absence of any requirement for chemical reactions in the process of so combining the respective materials. The combination seed capsules provide cooperative and beneficial effects of the soil conditioner and the optional inorganic fertilizer, working together in controlled intimate relation with the seed, to enhance the germination and growth processes of the seed, and the plant emergent therefrom, greater than when the soil conditioner and seed, and optionally inorganic chemical fertilizer, are applied to the soil separately; the improvement being a result of the intimate relationship of the respective materials in the combination seed capsule, whereby the respective materials cooperate with each other in support of germination and plant growth.

A0078 at Abstract.

Accordingly, "combination seed capsule" is properly construed as "*a seed capsule that provides cooperative and beneficial effects of said soil conditioning material working together in controlled intimate relation with said seed, to enhance the germination and growth processes of said seed and the plant emergent therefrom, said effects being greater than when said soil conditioning material and said seed are applied to the soil separately; wherein said effects result from an*

intimate relationship of said soil conditioning materials in said combination seed capsule, whereby said materials cooperate with each other in support of said germination and growth processes."

Encap also submitted the Declaration of Dr. Stanley Baker and inventors Mr. Madigan and Mr. Krysiak as evidence supporting its definition of "combination seed capsule." Each of these individuals reviewed the '259 patent and concluded that Encap's proposed definition reflects the understanding of one of ordinary skill in the art. A2598 at ¶ 14; A1008 at ¶ 9; A1055 at ¶ 12.

Finally, Scotts own Petition indicated "combination seed capsule" should have been construed as limiting. Specifically, while taking the position in its Reply that the term should not be construed because it was not limiting, Scotts conceded in its Petition that the term "combination seed capsule" ***should*** be defined and is therefore limiting. Specifically, the Petition asserted:

> The term "combination seed capsule" is described in the specification as comprising "at least one viable seed, having an outer surface and acting as a core or pseudo-core of said combination seed capsule; and a coating of a composition comprising a soil conditioning material mounted proximate, including disposed outwardly of the outer surface of said seed." ([A0086 at 4:5-11]). Likewise, the Abstract describes the "combination seed capsules" as including "both moieties of at least one soil conditioner and at least one seed, and optionally, one or more inorganic chemical fertilizer, growth enhancer, binder, and/or anti-fungal agent." ***Such construction*** is addition to being supported by the specification is also consistent with the construction afforded it in the copending ex parte re-examination and therefore ***should be controlling***.

A0126 (emphasis added).

Accordingly, this Court should reverse the Board's ruling that "combination seed capsule" is not limiting, adopt Encap's proposed construction, and in light of that construction reverse the Board on all bases of unpatentability.

B. The Board Improperly Construed "Soil Conditioning Material"

The Board's finding of anticipation of claims 1, 7, and 13 by Schreiber relies on its rejection of Encap's proposed construction of "soil conditioning material." A0023. Encap explained to the Board why this theory failed under its proposed construction. A1244-46. Scotts, moreover, did not dispute that this ground failed under Encap's proposal, choosing instead to argue the construction itself. A0924-40. Further, as discussed above, the Board's grounds of obviousness over Roth and Lowe and anticipation by Matthews (A0025) fail even under its adopted construction, and also fail under the correct construction.

Here, the Board erred by basing its construction of the phrase "soil conditioning material" on part, but not all, of the definition provided in the specification. Both parties and the Board agree that the phrase needs construction, and that the construction should be informed by the specification. The '259 patent defines ***all*** "soil conditioning materials" as:

> [A]ll soil conditioning materials contemplated herein beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients. By use of soil conditioner in intimate association with the

> seed, this invention not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated, and in intimate association with the seed, irrespective of the general tilth condition of the growth medium into or onto which the seed capsule is applied.

A0088 at 8:42.52.

This is the definition that the Board should have adopted and that this Court should now adopt on appeal. This definition is the correct definition of "soil conditioning material" when read in light of the specification by those of ordinary skill in the art (A2199 ¶ 11; A1008-09 ¶ 10) and is consistent and harmonized with the definition of "combination seed capsule" addressed above (A1055 ¶ 13). As previously discussed above, function matters for the materials being used to coat seeds in respect to their respective type, form, and quantity, as affirmed by both parties' experts. One seed coating's material(s), and the respective type, form and quantity would not necessarily accomplish a different function if applied to a different seed.

As discussed, the Board construed "soil conditioning materials" as: "Materials that beneficially modify the soil to which they are applied, in some way other than direct provision of nitrogen, phosphorus, and/or potassium or other plant nutrients, including for example, municipal or other sewer sludge, paper mill sludge, fly ash, and dust." A0011. This construction, however, addresses only ***part***

of the meaning defined by the ’259 patent specification. The definition must also include the next sentence in the specification to clearly understand its meaning.

Scotts admits as much, conceding in the Petition that:

> The patent characterizes ***all*** of its soil conditioning materials as materials which
>
> > beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients. By use of soil conditioner in intimate association with the seed, this invention not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated, and in intimate association with the seed, irrespective of the general tilth condition of the growth medium into or onto which the seed capsule is applied.

A0129 (emphasis added). In other words, exactly as proposed by Encap.

The Board also improperly included ***examples*** of “soil conditioning material” in its construction. A011. While these materials can be “soil conditioning materials,” they must fulfill the requirements of operating as a “soil conditioning material” as set forth below to be considered as such. In support of its position, Encap provided the Declaration of John Katers as one of at least ordinary skill in the art. A2198 ¶¶ 2-4. It is recognized by those of ordinary skill in the art that some sewage sludge, paper mill sludge, fly ash and dust may not beneficially modify the soil, or provide soil conditioning value to the seed so coated, irrespective of the general tilth condition of the growth medium into or onto which the seed capsule is applied). A2201-04 at ¶¶ 18, 19, 24. Therefore, specific examples of materials that

can operate as "soil conditioning materials," but do not always necessarily do so, should not be part of the definition of "soil conditioning material." *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1322 (Fed. Cir. 2012) (examples not meant to be definitive of claim scope).

Because the examples are illustrative and not prescriptive, *i.e.*, the broad categories of examples are not necessarily "soil conditioning materials," the Board erred by including in the construction. And as discussed above, including the examples corrupted the whole analysis, as Scotts presented only attorney argument that the general categories of material identified in the various prior art references were within the exemplary categories, and no evidence that any of the disclosed materials expressly or inherently acted as a "soil conditioning material."

Accordingly, this Court should vacate the Board's construction of "soil conditioning material," adopt Encap's proposed construction, and in light of that construction reverse the Board on all bases of unpatentability.

VI. The Board Erroneously Denied Encap's Motion to Amend

The Board also improperly denied Encap's motion to amend and improperly required Encap to prove that its substitute claims were patentable. Encap's motion requested that if the Board found all of the challenged claims to be unpatentable, then it should replace those claims with Encap's ten proposed substitute claims. A1201. Thus, to the extent that this Court affirms the Board that all challenged

claims are unpatentable, it should remand to the Board with instructions to enter the proposed amendment and replace the original claims with the substitute claims. To the extent that this Court reverses the Board in part or in full such that one or more challenged claims are sustained, Encap's motion to amend becomes moot.

The Board's errors in denying Encap's motion to amend extend beyond this case. In the two-plus years that the Board has conducted *inter partes* reviews, it has proceeded down an inefficient path contrary to the statute and PTO regulations. Against reason, *inter partes* review proceedings—like court proceedings now—often turn on debates over proper claim constructions. Often, the patent owner will assert a more narrow construction under the broadest reasonable interpretation standard (or assert that such standard is not applicable) to enhance the arguments for patentability. The petitioner, on the other hand, may advance a broad construction to maximize its chances of prevailing, secure knowing that (unlike in an infringement litigation) it is not harming its non-infringement defenses by asserting a broad construction. While this may be unavoidable in court, it makes no sense that it is the Board's standard practice in a proceeding before the PTO where the authorizing statute permits amendment.

In a standard prosecution, there are seldom disputes as to claim construction because if the patent owner believes that the Examiner is construing the claims too broadly, the claim can be amended as a matter of course. Debates over

"construction" are not necessary, because the patent owner can, easily and efficiently, expressly put the meaning in the claim itself. Nor does the PTO require applicants to "construe" the amended language. In an *inter partes* review, however, the expedient of amendment is denied through improper substantive and procedural hurdles imposed by the Board. The Board seems to believe incorrectly that these hurdles are necessary for efficiency. The efficient approach, however, is what the statute anticipates and is consistent with examination practice: allow the claims to be narrowed by amendment to avoid the prior art, thus obviating the need for the Board to construe claims and perform unnecessary prior art analysis.

A. Encap's Motion to Amend Complied with the Applicable Statute and Regulation

Here, the Board should have allowed Encap to amend the '259 patent by substituting the claims because Encap's proposed amendment is permitted under the statute and the PTO's rules. A patent owner in an *inter partes* review is permitted to file one motion to amend the patent to "propose a reasonable number of substitute claims" "[f]or each challenged claim." 35 U.S.C. § 316(d)(1)(B). The motion must

> include a claim listing, show the changes clearly, and set forth: (1) The support in the original disclosure of the patent for each claim that is added or amended; and (2) The support in an earlier-filed disclosure for each claim for which benefit of the filing date of the earlier filed disclosure is sought.

37 C.F.R. § 42.121(b). The PTO's rules prescribe ***two*** circumstances where a motion to amend may be denied: (1) where the "amendment does not respond to a ground of unpatentability involved in the trial" and (2) where the "amendment seeks to enlarge the scope of the claims of the patent or introduce new subject matter." 37 C.F.R. § 42.121(a)(2).

Encap's motion to amend satisfied each of the statutory and regulatory criteria. Encap proposed one substitute claim for each of the ten challenged claims it sought to replace. A1201. Encap explained that its amendment would not enlarge the scope of any claims, and that the amended language of the substitute claims was responsive to a ground of unpatentability involved in the trial. A1201, A1205-15. Encap also set forth the support in the original disclosure for each substitute claim. A1201-1205. The Board did not question any of this. A0029-33.

B. The Board's Reasons for Denying Encap's Motion to Amend are Not in Accordance with Law

The patent owner's opportunity to amend its claims at least once was the PTO's justification for applying the "broadest reasonable interpretation" claim construction standard to *inter partes* review, rather than the more limited standard applicable in district court litigation where amendment is not permitted.[1] Unlawful

[1] *See* Changes To Implement *Inter Partes* Review Proceedings, Post-Grant review Proceedings, and Transitional Program for Covered Business Method Patents, 77 Fed. Reg. 48,680, 48,688 (Aug. 14, 2012) ("[A] party's ability to amend claims to avoid prior art—which exists in these proceedings (§ 42.121)—distinguishes

denial of the opportunity to amend undermines the legitimacy of the Board's proceeding.

The Board denied Encap's motion to amend because it found that Encap failed to demonstrate in its motion the patentability of the substitute claims. A0029. But the PTO's regulations do not and could not require Encap to show that the substitute claims would be patentable. Rather, to establish that it was entitled to "the requested relief" of amendment, Encap only needed to show that it met each of the requirements of 37 C.F.R. § 42.121. As discussed above, that rule requires, among other things, that a patentee show that a proposed amendment ***responds to*** an asserted ground of unpatentability. 37 C.F.R. § 42.121(a)(2)(i). But it does not permit the Board to require a patentee to establish patentability as a condition of amending with substitute claims.

The requirement that a proposed amendment be ***responsive*** to an asserted ground of unpatentability makes sense: the purpose of allowing amendment in an *inter partes* review proceeding is to allow the patentee to address the arguments raised by the petitioners, not to amend for other reasons. By its plain terms, the regulation does not allow the Board to deny a motion to amend because the patentee has not established, in the motion, that the substitute claim would be patentable under a particular claim construction.

Office proceedings from district court proceedings and justifies the broadest reasonable interpretation standard for claim interpretation.").

On the contrary, the purpose of the trial is to evaluate patentability, and if a substitute claim is properly before the Board—because the motion to amend meets the requirements of section 42.121, as Encap's did—the patentability of that substitute claim must be evaluated in light of all of the evidence, not on a motion to amend. The Board's conclusion that Encap bore the burden of demonstrating patentability misstated Encap's burden and would turn every such motion into a mini-trial of the merits.

The Board's reliance on Section 42.20(c) to impose these requirements is misplaced: that provision simply states that the moving party bears the burden of demonstrating entitlement to relief. It does not establish any substantive standard to apply in evaluating any particular motion. The Board's reasons for denying Encap's motion are contrary to the PTO's regulations and cannot be sustained. *See Align Tech., Inc. v. ITC*, __ F.3d __, Nos. 2013-1240, -1363, slip op. at 10 (Fed. Cir. July 18, 2014) (setting aside decision "[b]ecause the Commission circumvented its own rules"); *United States v. UPS Customhouse Brokerage, Inc.*, 575 F.3d 1376, 1382 (Fed. Cir. 2009) ("An agency must follow its own regulations.").

Moreover, the Board's ruling that a patentee bears the burden of proving the patentability of a proposed substitute claim conflicts with the statute. "In an *inter partes* review . . . , the petitioner shall have the burden of proving a proposition of

unpatentability by a preponderance of the evidence." 35 U.S.C. § 316(e). This statutory command is not limited to the proof of unpatentability required to invalidate existing claims; by its terms, it applies to any proposition of unpatentability that arises in an *inter partes* review.

Accordingly, any regulation purporting to place the burden on a patentee to demonstrate that a proposed substitute claim is patentable as a condition of amendment would conflict with § 316(e) and would be unlawful. *Rambus, Inc. v. Rea*, 731 F.3d 1248, 1255 (Fed. Cir. 2013). Although Congress gave the PTO authority to promulgate regulations "setting forth standard and procedures for allowing the patent owner to move to amend the patent under [§ 316(d)]," 35 U.S.C. § 316(a)(9), this delegation did not confer on the PTO the authority to change § 316(e)'s statutory burden of proof. *United States v. Mead Corp*., 533 U.S. 218, 227 (2001); *GHS Health Maint. Org., Inc. v. United States*, 536 F.3d 1293, 1297 (Fed. Cir. 2008).

The unlawfulness of the Board's ruling and Board precedent also is evident from the arbitrary and capricious procedural obstacles it imposes on a patent owner seeking to amend. The Board strictly enforces a limit of 15 pages of double-spaced, 14 point font, which is the standard page limit for any motion in *inter partes* review proceedings. 37 C.F.R. § 42.24(a)(1)(v). This 15-page limit must include a listing of all claims, *SATA GmbH & Co. KG v. Anest Iwata Corp.*,

IPR2013-00111, Paper No. 20 at 2 (PTAB Aug. 7, 2013) ("The rule contemplates that the claim listing be a part of the motion to amend, and not filed as a separate paper. Thus, the listing of claims is included in the 15 page limit set forth per 37 C.F.R. § 42.24(a)(1)(v) for motions."), unless the panel arbitrarily decides that it does not, *Corning Optical Communications RF, LLC v. PPC Broadband, Inc.*, IPR2014-00411, Paper 19 at 2 (PTAB Oct. 30, 2014) ("We also authorized Patent Owner to place its proposed substitute claims in an appendix, such that it does not count toward the 15-page limit for a motion to amend claims."). The 15 pages must also, for example, show specification support not only for new or amended limitations but for the claims as a whole, *Nichia Corp. v. Emcore Corp.*, IPR2012-00005, Paper No. 27 at 4 (June 3, 2013), must provide claim constructions for new claim terms, *CBS Interactive Inc. v. Helferich Patent Licensing, LLC*, IPR 2013-00033, Paper No. 122 at 51-52 (PTAB March 3, 2014), must address the level of ordinary skill in the art regarding each added feature added to the proposed substitute claims, *Toyota Motor Corp. v. Am. Vehicular Sciences, Inc.*, IPR2013-00419, Paper No. 32 at 4 (PTAB March 7, 2014), must discuss how one of ordinary skill would have viewed the newly recited claim limitations, *Microsoft Corp. v. Proxyconn, Inc.*, IPR2013-00109, Paper No. 16 at 55 (PTAB Feb. 19, 2014), and must prove patentability of each substitute claim over all known prior art, *Idle Free Sys. v. Bergstrom, Inc.*, IPR2012-00027, Paper 66 at 31-33 (PTAB

Jan. 7, 2014). These requirements were imposed in this case as well. A0909-10; A0029-33 (citing *Idle Free Sys. v. Bergstrom, Inc.*, IPR2012-00027, Paper 26 (PTAB June 11, 2013). The PTO might as well impose a five-page or a one-page limit: there is no practical way to meet the Board's asserted requirements for a motion to amend.

Consideration of the Board's unlawful substantive and procedural requirements reveals that the provision to amend within an *inter partes* review does not comport with Congress's directive. After more than two years of proceedings, not a single contested motion to amend has been granted by the Board. Indeed, the only motion granted was an unopposed motion where the patent owner was another agency of the federal government. Earlier this year, the PTO itself solicited comments on several aspects of the Board's practice, including on "What modifications, if any, should be made to the Board's practice regarding motions to amend?" 79 C.F.R. 36474, 36476. Many of the comments, moreover, raised concerns about the inability to amend claims. *See* Michael Loney, *Last Minute Submissions Push PTAB Comments Total to 37*, Managing Intellectual Property (Oct. 18, 2014), http://www.managingip.com/Article/3391665/Managing-Patents-Archive/Last-minute-submissions-push-PTAB-comments-total-to-37.html (last visited Dec. 3, 2014). While the PTO's internal assessment and

reconsideration of this issue is warranted, such future steps cannot cure the past mistakes in this case and in others.

Accordingly, this Court should, if necessary, direct the Board to enter Encap's proposed substitute claims as written.

CONCLUSION AND RELIEF SOUGHT

For the reasons set forth above, Encap respectfully requests that this Court reverse the Board's decision and rule that Scotts had not met its burden of establishing unpatentability of any challenged claim of the '259 patent. To the extent that this Court affirms the unpatentability rulings of all challenged claims, Encap further requests that this Court rule that Encap satisfied its statutory and regulatory burdens to demonstrate entitlement to amend with substitute claims, and remand with an order that the PTAB grant Encap's motion to amend.

Respectfully submitted
this 15th day of December, 2014,

/s/Philip M. Weiss

Philip M. Weiss
Weiss & Weiss
410 Jericho Turnpike, Suite 105
Jericho, NY 11753
Telephone: (516) 739-1500
Email: weissandweiss@aol.com

Aaron T. Olejniczak
Andrus Intellectual Property Law, LLP
100 East Wisconsin Avenue, Suite 1100
Milwaukee, WI 53202
Phone: 414-271-7590
Telefax: 414-271-5770
Email: aarono@andruslaw.com

Attorneys for Appellant Encap, LLC

CERTIFICATE OF FILING AND SERVICE

This is to certify that on this15th day of December, 2014 the foregoing Brief of Appellant Encap, LLC was electronically filed via CM/ECF and was served via CM/ECF to the following counsel of record:

Robert Schulman Hunton & Williams LLP 2200 Pennsylvania Avenue, N.W. Washington, D.C. 20037 rschulman@hunton.com	David A. Kelly Hunton & Williams LLP 600 Peachtree Street, NE Atlanta, GA 30308 dkelly@hunton.com

Paper copies were also served via U.S. mail to the following:

Office of the General Counsel United States Patent and Trademark Office 10B20, Madison Building East 600 Dulany Street Alexandria, VA 22314	Patent Trial and Appeal Board United States Patent and Trademark Office Madison Building East 600 Dulany Street Alexandria, VA 22314

/s/Philip M. Weiss
Philip M. Weiss
Weiss & Weiss
410 Jericho Turnpike, Suite 105
Jericho, NY 11753
Telephone: (516) 739-1500
Email: weissandweiss@aol.com

Attorney for Appellant Encap, LLC

CERTIFICATE OF COMPLIANCE

The undersigned certifies the following: This brief complies with the type-volume limitation of Federal Rule of Appellate Procedure 32(a)(7)(B). The brief contains 11,777 words, as measured by the word processing software used to prepare this brief, including headings, footnotes, and quotations, and excluding the corporate disclosure statement, table of contents, table of citations, addendum, and certificates of counsel. This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type style requirements of Federal Rule of Appellate Procedure 32(a)(6). The brief has been prepared in a proportionally spaced typeface using Microsoft Word 2010 in 14 point Times New Roman font.

/s/Philip M. Weiss
Philip M. Weiss
Weiss & Weiss
410 Jericho Turnpike, Suite 105
Jericho, NY 11753
Telephone: (516) 739-1500
Email: weissandweiss@aol.com

Attorney for Appellant Encap, LLC

Trials@uspto.gov
571-272-7822

Paper 79
Date: June 24, 2014

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THE SCOTTS COMPANY LLC
Petitioner

v.

ENCAP, LLC
Patent Owner

Case IPR2013-00110
Patent 6,209,259

Before MICHAEL P. TIERNEY, LORA M. GREEN, and RAMA G. ELLURU, *Administrative Patent Judges.*[1]

PER CURIAM.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

[1] Floyd, Administrative Patent Judge, who participated in the oral hearing held on January 30, 2014, has left the Board; accordingly, Tierney, Administrative Patent Judge, has been added to the panel.

I. BACKGROUND

Petitioner, The Scotts Company LLC ("Scotts Company"), filed a Petition on January 10, 2013, for an *inter partes* review of claims 1-5, 7-11, 13, and 14 ("the challenged claims") of U.S. Patent No. 6,209,259 ("the '259 patent") pursuant to 35 U.S.C. §§ 311-319. Paper 2. On April 15, 2013, Patent Owner, Encap, LLC ("Encap"), filed a Preliminary Response. Paper 9. On July 3, 2013, the Board granted an *inter partes* review for all challenged claims on less than all of the grounds of unpatentability alleged in the Petition. Paper 12, ("Dec."). The Board also stayed concurrent reexamination of the '259 patent. Paper 10.

After institution of trial, Encap filed a Corrected Patent Owner's Response. Paper 48. Encap also filed a Corrected Contingent Motion to Amend Claims that requests substituting proposed new claims 15-24 for claims 2-5, 8-11, 13, and 14, respectively—contingent upon a determination of unpatentability. Paper 47. Scotts Company filed a Reply to Patent Owner's Response (Paper 30), and an Opposition to Encap's Motion to Amend Claims (Paper 33). Encap then filed a Corrected Reply to Scotts Company's Opposition to Encap's Motion to Amend Claims. Paper 49.

Additionally, Scotts Company filed a Motion to Exclude Evidence (Paper 52), to which Encap responded (Paper 64) and submitted supplemental evidence (Paper 58). Scotts Company filed a Reply in further support of its Motion to Exclude. Paper 68.

Encap also filed a Motion to Exclude Evidence (Paper 54) to which Scotts Company responded (Paper 60). Encap, with authorization (Paper 70), filed a Supplement to its Motion to Exclude (Paper 66), as well as a Reply (Paper 67).

Oral hearing was held on January 30, 2014.[2]

The Board has jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

Scotts Company has shown by a preponderance of the evidence that claims 1-5, 7-11, 13, and 14 of the '259 patent are unpatentable. Encap's Motion to Amend Claims is denied.

A. The '259 Patent

The '259 patent is directed to a combination seed capsule, comprising at least one viable seed, a coating of a composition comprising a soil conditioning material mounted proximate and disposed outwardly of the outer surface of the seed, and optionally including one or more of inorganic chemical fertilizers, growth enhancer, binder, and/or an anti-fungal agent. Ex. 1001, Abstract, 4:5-11. According to the '259 patent Specification, the primary object of the invention is to "provide solid plant seed capsule products that supply both soil conditioning properties and the seed, which can benefit from such conditioned soil, in a given seed capsule particle." *Id.* at 3:28-31.

B. Illustrative Claim

Claims 1 and 7 are the only independent claims in the '259 patent, and are directed to a "[a] combination seed capsule." The only difference between these claims is that claim 7 additionally states that the seed coating is applied by an agglomeration process. The remaining challenged claims depend from either claim 1 or 7. Claim 1 is illustrative of the claimed subject matter, and is reproduced below.

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[2] A transcript of the oral hearing is included in the record as Paper 78.

1. A combination seed capsule comprising:

one viable seed;

said seed acting as a core or pseudo core of said combination seed capsule;

a coating of a composition comprising soil conditioning materials;

said soil conditioning materials being in a solid state at time of coating.

C. Prior Art Supporting the Instituted Challenges

Name	Reference	Issue or Publication	Exhibit
Schreiber	U.S. Patent No. 3,698,133	Oct. 17, 1972	Ex. 1002
Roth	U.S. Patent No. 4,065,287	Dec. 27, 1977	Ex. 1003
Lowe	U.S. Patent No. 5,019,564	May 28, 1991	Ex. 1004
Matthews	GB670,461	Apr. 16, 1952	Ex. 1007

D. The Instituted Challenges of Unpatentability

References	Grounds	Claims
Schreiber	§ 102(b)	Claims 1, 7, and 13
Schreiber and Roth	§ 103(a)	Claims 2, 5, 8, 11, and 14
Schreiber and Lowe	§ 103(a)	Claims 3, 4, 9, and 10
Matthews	§ 102(b)	Claims 1, 2, 7, 8, 13, and 14
Roth	§ 102(b)	Claims 1, 2, 5, 7, 8, 11, 13, and 14
Roth and Lowe	§ 103(a)	Claims 1-5, 7-11, 13, and 14

II. DISCUSSION

A. Evidentiary Matters

1. Scotts Company's Reply (Paper 30)

In a conference call held on December 3, 2013, Encap asserted that Scotts Company had raised new arguments and evidence in its Reply to Patent Owner's Response to Decision to Institute. Order (Paper 37), 2. The Board denied Encap's request to file a surreply, or to enlarge the page limit of Encap's Reply in support of its Motion to Amend. *Id.* We indicated, however, that we would determine whether Scotts Company's Reply and supporting evidence contain material exceeding the proper scope of a reply. *Id.*

We find that Scotts Company's Reply, and in particular, the supporting Declarations of Mr. Fredrick Sundstrom (Ex. 1039) and Mr. Krishna Pagilla (Ex. 1040) contain material outside the proper scope of a reply. 37 C.F.R. § 42.23(b) (reply is limited to arguments raised in Patent Owner's Response). Specifically, both Declarations contain materials in support of Scotts Company's Petition, and therefore, untimely filed. For example, Mr. Sundstrom includes analyses of claim construction (e.g., Ex. 1039 ¶¶ 7-9), as well as analyses of the Schreiber (e.g., *id.* at ¶¶ 10-13), Matthews (e.g., *id.* at ¶¶ 28, 29), Roth (e.g., *id.* at ¶ 34), Simmons (*id.* at ¶¶ 36, 38), and Evans (*id.* at ¶¶ 43, 44, 46, 48) references. Likewise, Mr. Pagilla addresses claim construction, as well as the references upon which Scotts Company sought institution. *See, e.g.*, Ex. 1040 ¶¶ 9-13, 23-27, 32, 33, 36-38. Specifically, we hold that the new evidence could have been included with the motion. By waiting to serve this evidence on Encap in Scotts Company's Reply, Encap was denied the opportunity to file responsive evidence. Thus, we

have not considered the untimely Declarations of Mr. Sundstrom and Mr. Pagilla, nor the arguments based thereon.[3]

2. Scotts Company's Motion to Exclude

Scotts Company filed a Motion to exclude: portions of the deposition testimony of Mr. Michael Krysiak taken by Encap on November 6, 2013 (Ex. 2002) and December 23, 2013 (Ex. 1038); and the Second Krysiak Declaration, which includes Attachments A and B (Ex. 2016). Pet. Mot. Excl. (Paper 52), 1. Mr. Krysiak, Encap's witness, submitted a second Declaration (Ex. 2012) in support of its Reply to Petitioner's Opposition to Encap's Motion to Amend (Paper 49). Encap responded to Scotts Company's Motion to Exclude and filed supplemental evidence. PO Resp. Mot. Excl. (Paper 64); PO Supp. Evid. (Paper 58), respectively. Scotts Company filed a Reply. Paper 68. We grant-in-part Scotts Company's Motion to Exclude Evidence.

Scotts Company asserts that Mr. Krysiak's deposition testimony in response to two questions (i.e., Ex. 2002, 207, l. 9; Ex. 1038, 209, ll. 7-8) should be excluded. Pet. Mot. Excl. 9-10. As we did not rely upon this deposition testimony that Scotts Company seeks to exclude, Scotts Company's Motion is moot with respect to such testimony.

Scotts Company also moves to exclude the Second Declaration of Mr. Krysiak (Ex. 2012). Scotts Company's primary objection is that the Declaration is untimely, as it should have been submitted with Encap's Motion to

[3] The fact that two declarations may contain some material appropriate for a response does not require our consideration of them, as the Board will not attempt to sort the proper from the improper portions. *See Office Patent Trial Practice Guide*, 77 Fed. Reg. 48,756, 48,767 (Aug. 14, 2012).

Amend (Paper 47). Pet. Mot. Excl., 11-14; *see* 37 C.F.R. § 42.23(b) ("All arguments for the relief requested in a motion must be made in the motion. A reply may only respond to arguments raised in the corresponding opposition or patent owner response."). In support of Scotts Company's Opposition to Encap's Motion to Amend (Paper 33), it relied upon the Declaration of Mr. Sundstrom (Ex. 1039), which was not considered, as discussed above. Encap asserts that Mr. Krysiak's Second Declaration is in rebuttal to Declarations and deposition testimony of Mr. Sundstrom and Mr. Pagilla. PO Resp. Mot. Excl. 10-11. Encap proffers supplemental evidence—a revised Second Declaration of Mr. Krysiak with citations to the Declaration and deposition of Mr. Sundstrom. Paper 58; Ex. 2016.

Reading Mr. Krysiak's Second Declaration, it is clear that the majority of the Declaration is in support of Encap's Motion to Amend rather than in rebuttal to Scotts Company's Opposition to Encap's Motion to Amnd or the Declarations and deposition testimony[4] of Mr. Sundstrom and Mr. Pagilla, and is thus, untimely. For example, paragraphs 2-3 relate to written description and claim construction, which Encap has the burden of proving in its Motion to Amend. Additionally, paragraphs 6-12 describe the background of the technology, which could have been submitted with Encap's Motion to Amend opening brief, and thus, are not in rebuttal to testimony from Mr. Sundstrom or Mr. Pagilla. Likewise, paragraphs 25-53 and Schedule A attempt to distinguish over Matthews and Schreiber, which Encap should have done in Patent Owner's Motion to Amend. Furthermore, to the extent that portions of Mr. Krysiak's Second Declaration are in response to the

[4] While not addressed, we do not suggest that filing a declaration in rebuttal to deposition testimony is appropriate.

Declarations of Mr. Sundstrom and Mr. Pagilla, which were excluded, they should likewise be excluded. Those errors were not corrected in the Supplemental Evidence (i.e., Ex. 2016) submitted by Encap.

In addition, Encap attempts to incorporate Mr. Krysiak's Second Declaration into its Reply to Scott's Opposition to the Motion to Amend by merely stating, "The proposed claims define over the prior art succinctly. *Id.* [Mr. Krysiak's Second Declaration] at ¶¶ 14-53." Reply Mot. Amend 5. In our Order of August 27, 2013, we admonished Encap to refrain from attempting to use an expert declaration in such fashion. We stated, "Encap's motion to amend may be supported by an expert declaration, but that the motion itself should set forth the arguments and explanations with appropriate pinpoint citations to the expert declaration, rather than incorporating by reference the expert declaration." Paper 17, 2-3. Thus, Scotts Company's Motion to Exclude Mr. Krysiak's Second Declaration (Ex. 2012) is granted, as Mr. Krysiak's Corrected Second Declaration (Ex. 2016) did not remedy the issues, it is not considered.

3. Encap's Motion to Exclude

Encap moves to exclude the Declaration of Mr. Sundstrom (Ex. 2014), Scott Company's witness who provided a declaration in support of Scott Company's Reply to Patent Owner's Response to Decision to Institute (Paper 30), on the basis that the declarant refused to answer certain questions during his deposition on the basis of confidentiality, even though a protective order was in place. PO Mot. Excl. (Paper 54), 5. Having found that Mr. Sundstrom's Declaration was untimely submitted, and thus, not considered, Encap's Motion to Exclude is dismissed as moot.

B. Claim Construction

Consistent with the statute and the legislative history of the AIA, the Board interprets claims by applying the broadest reasonable construction in the context of the specification in which the claims reside. 37 C.F.R. § 42.100(b); *see Office Patent Trial Practice Guide*, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012). Claim terms also are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc*., 504 F.3d 1249, 1257 (Fed. Cir. 2007).

Two exceptions to the general rule that a claim term is given its ordinary meaning are: 1) when a patentee sets out a definition and acts as his own lexicographer; or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Id.*

1. "soil conditioning materials"

All of the challenged claims require "a coating of a composition comprising soil conditioning materials." The '259 patent Specification states that "*all soil conditioning materials contemplated herein* beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients." Ex. 1001, col. 8, ll. 41-44 (emphasis added). The Specification further provides specific examples of soil conditioning materials, such as municipal or other sewage sludge, paper mill sludge, fly ash, and dust. *Id*. at col. 7, ll. 21-23. Accordingly, in the Decision to Institute, the Board construed "soil conditioning materials" as "materials that beneficially modify soil

to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients, including for example, municipal or other sewage sludge, paper mill sludge, fly ash, and dust." Dec. 6-7.

Although Scotts Company agrees with the Board's preliminary construction (Pet. Reply, 1-2), Encap asserts the construction is overly broad in view of the Specification (PO Resp., 8-9). Specifically, Encap asserts the construction should be amended to include that the soil conditioner not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated irrespective of the general tilth condition of the growth medium. *Id.* (citing Ex. 1001, col. 8, ll. 42-52,[5] Abstract). Encap does not assert that its construction is the plain and ordinary meaning of "soil conditioning materials," but rather, that the Specification defines the phrase. PO Resp. at 8. Specifically, Encap asserts the following portion of the Specification defines "soil conditioning materials:"

> However, all soil conditioning materials contemplated herein beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients. By use of soil conditioner in intimate association with the seed, this invention not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated, and in intimate association with the seed, irrespective of the general tilth condition of the growth medium into or onto which the seed capsule is applied.

Ex. 1001, col. 8, ll. 42-52.

Through the inclusion of "all soil conditioning materials contemplated herein," the first sentence requires the soil conditioning material to beneficially

[5] Encap mistakenly refers to col. 15, l. 29–col. 16, l. 6.

modify the soil in some way, other than directly providing plant nutrients. The second sentence is an observation of benefits provided by "this invention;" it does not *require* the invention provide the observed benefits; much less require *just* the soil conditioning material of the invention provide such benefits.

Encap relies upon its experts, Mr. John Katers, Mr. Daniel Madigan, and Mr. Michael Krysiak, all of whom provide identical claim constructions, in support of its position. Ex. 2007 ¶ 11; Ex. 1020 ¶ 10; Ex. 1022 ¶ 13. The experts provide, however, no credible analysis in support of their claim constructions, and thus, are unpersuasive.

Encap asserts also that the examples included in the Board's preliminary claim construction should be omitted, because not *all* municipal or other sewage sludge, paper mill sludge, fly ash, or dust, necessarily modify the soil in a beneficial manner. PO Resp. 9. The Board's preliminary construction, however, requires the soil conditioning materials "modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients." The inclusion of the examples is intended to clarify, not modify, this requirement.

Accordingly, the Board maintains its construction of "soil conditioning materials" as:

> Materials that beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients, including for example, municipal or other sewage sludge, paper mill sludge, fly ash, and dust.

2. "combination seed capsule"

The phrase "combination seed capsule" appears in the preamble of claims 1 and 7. Encap asserts that the Abstract of the '259 patent defines "combination seed capsule." PO Resp. 10-11. The Abstract reads:

> This invention pertains to combination seed capsules wherein each seed capsule includes both moieties of at least one soil conditioner and at least one seed, and optionally, one or more inorganic chemical fertilizer, growth enhancer, binder, and/or anti-fungal agent. The combination seed capsules are made by physically combining the respective soil conditioner and seed with one other, in the absence of any requirement for chemical reactions in the process of so combining the respective materials. The combination seed capsules *provide cooperative and beneficial effects of the soil conditioner* and the optional inorganic fertilizer, *working together in controlled intimate relation with the seed, to enhance the germination and growth processes of the seed, and the plant emergent therefrom, greater than when the soil conditioner and seed*, and optionally inorganic chemical fertilizer, *are applied to the soil separately; the improvement being a result of the intimate relationship of the respective materials in the combination seed capsule, whereby the respective materials cooperate with each other in support of germination and plant growth.*

Ex. 1001, Abstract (emphases added). Encap asserts that the text that has been italicized is the definition of a "combination seed capsule." PO Resp. 11. Encap also relies upon its technical experts, Messrs. Baker, Madigan, and Krysiak. *Id.* at 11-12. The experts, however, provide no credible analysis in support of their claim constructions and are thus, unpersuasive.

Scotts Company asserts that the term "combination seed capsule" appears in the preamble of both independent claims (i.e., claims 1 and 7), and thus, is not limiting. Pet. Reply 2. Scotts Company also asserts that in 1998, when the application that matured into the '259 patent was filed, the rules prohibited relying

on the Abstract "for interpreting the scope of the claims." *Id.* at 3 (quoting 37 C.F.R. § 1.72(b)). Lastly, Scotts Company asserts that Encap is attempting to improperly import limitations into the claims. *Id.*

First, the Abstract does not provide a definition for a "combination seed capsule," but rather observes the benefits of the combination seed capsule. Second, the preamble term "combination seed capsule" is not limiting because the claim body describes a structurally complete invention. *Catalina Mktg. Int'l v. Coolsavings.com Inc.*, 62 USPQ2d 1781, 1785 (Fed. Cir. 2002). Thus, we need not construe "combination seed capsule," as it does not limit the claim.

3. "being in a solid state at time of coating"

Independent claim 1 recites, "being in a solid state at time of coating." Similarly, independent claim 7 recites, "are in a solid state at time of coating." Additionally, claim 7 recites, "said coating being applied to said viable seed by an agglomeration operation." Due to the inclusion of these three limitations, claims 1 and 7 were determined to be product-by-process claims in the Decision to Institute. Dec. 7-8.

Encap asserts that "in a solid state at time of coating" should be construed as "solid material in the form of particulate, fibrous, or a suspension of a particulate or fibrous material in a liquid carrier to form an agglomeration of said particulate and/or fibers." PO Resp. 12-13 (citing Ex. 1001, col. 8, ll. 1-5[6]). Scotts Company points out that the Specification reads, the soil conditioning raw material "*may* be a particulate powder, or *may* be fibrous, or *may* be a suspension of a powder or fibrous material in a liquid carrier, and is preferably coated onto the substrate seed

[6] Encap erroneously cites to col. 14, ll. 24-28.

to form a seed capsule or other agglomeration of particles, fibers, *or the like*," and thus, does not support Encap's construction. Pet. Reply 3 (quoting Ex. 1001, col. 8, ll. 1-5 with emphasis added). We agree that the Specification does not support Encap's proposed construction.

Encap further asserts that during prosecution of the '259 patent application, Mr. Krysiak had discussions with the Examiner relating to "being in a solid state at the time of coating." PO Resp. 12 (citing Ex. 1022 ¶ 15). Encap's description of events does not provide support for its proposed claim construction. That is, it does not follow that adding the limitation to overcome Roth, defines the limitation to require "solid material in the form of particulate, fibrous, or a suspension of a particulate or fibrous material in a liquid carrier to form an agglomeration of said particulate and/or fibers." As before, Mr. Krysiak's opinion as to how the phrase should be construed includes no analysis, and thus, is unpersuasive.

Encap does establish that it disavowed claim scope, however, by adding the limitation "in a solid state at time of coating" to overcome Roth. That clear and unambiguous disavowal of claim scope causes us to modify the claim construction from that set forth in the Decision to Institute. Specifically, Encap narrowed the "in a solid state at time of coating" limitation to require the soil conditioning material be in a solid state at the time of coating the seed. Encap did not narrow "in a solid state at time of coating," however, to further require a particulate, fibrous, or a suspension of a particulate or fibrous material in a liquid carrier to form an agglomeration of said particulate and/or fibers, as suggested by Encap.

The Federal Circuit has addressed the issue of determining whether a claim has been narrowed in the related context of prosecution history estoppel.

> In order to give due deference to public notice considerations under the *Warner–Jenkinson* framework, a patent holder seeking to establish

> the reason for an amendment must base his arguments solely upon the public record of the patent's prosecution, i.e., the patent's prosecution history. To hold otherwise—that is, to allow a patent holder to rely on evidence not in the public record to establish a reason for an amendment—would undermine the public notice function of the patent record.

Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 234 F.3d 558, 586 (Fed. Cir. 2000), *vacated on other grounds*, 535 U.S. 722 (2002).

An examination of the prosecution history of record reveals the following events which support our determination that Encap clearly disavowed the full scope of claims 1 and 7. On May 10, 2000, the Examiner issued a rejection to claim 77 as anticipated by Roth, and further rejected claims 77 and 85 as being obvious in view of Roth in combination with two other references. Ex. 1008, 171, 175.[7] On August 8, 2000, the Examiner issued an interview summary, which indicates that a proposed claim amendment was discussed. Specifically, the Examiner stated that adding, "wherein said soil conditioning material, when added to the seed, are in a dry, solid form," to the claims would overcome Roth. The Examiner suggested "that the claims be written in a product by process form to clearly distinguish over Roth." *Id.* at 203. On September 8, 2000, the Examiner issued an Interview Summary indicating that claims 77 and 85 were discussed, and that "[b]ased on the proposed draft amendment and arguments recited therein, the prior art was overcome." *Id.* at 204. The record clearly shows that the only amendment made to claim 77 was the addition of the limitation, "said soil conditioning materials being in a solid state at time of coating." *Id.* at 200. Claim 85 was amended in similar fashion to recite, "wherein said soil conditioning

[7] Claims 77 and 85, ultimately issued as claims 1 and 7, respectively.

materials are in a solid state at time of coating." *Id.* at 201. Claims 77 and 85 ultimately issued as claims 1 and 7, respectively.

Thus, Encap successfully overcame Roth by adding the "in a solid state at the time of coating" limitation to claims 1 and 7. Construing the phrase as a product-by-process limitation would not result in distinguishing over Roth, as no discussion was had, nor evidence provided, to suggest the end product of Roth had different characteristics than the claimed composition. The disavowal of claim scope is clear. The limitation "in a product by process form," therefore, must be construed to require the soil conditioning material be in a solid state at the time of coating. *See Tempo Lighting, Inc. v. Tivoli, LLC*, 742 F.3d 973, 978 (Fed. Cir. 2014).

Furthermore, Roth discloses a spray application of a MAS material that contains 0.1% to 2.5% solids at the time of coating. Ex. 1003, col. 3, ll. 50-51. Thus, the limitation "in a solid state at the time of coating" must further be construed to require more than 2.5% solids. Therefore, we construe "in a solid state at the time of coating" to mean that more than 2.5% of the soil conditioning material must be in a solid state at the time of coating the seed.

4. "agglomeration operation"

Independent claim 7 requires an "agglomeration operation," which we construed in our Decision to Institute to be a product-by-process limitation. Dec. 8. Patent Owner concedes that claim 7 is a product-by-process claim. PO Resp. 16. Patent Owner, however, takes issue with the Board's "holding" that an agglomeration operation means using water and heat to bind a plurality of particles. *Id.* at 13.

We did not construe "agglomeration operation," other than to note that it is a product-by-process limitation. *In re Thorpe*, 777 F.2d 695, 698 (Fed. Cir. 1985). The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art. *See, e.g.*, *In re Garnero*, 412 F.2d 276, 279 (CCPA 1969). That is especially true where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. *Id*. Thus, the issue is not focused on what "agglomeration operation" means, but rather on what properties would be embodied in a product made by an agglomeration operation (i.e., an agglomerate). Here, the parties are in near agreement on the properties of an agglomerate.

Encap states that an agglomerate is an assemblage of particles adhering to each other, and thus, a magnified image of an agglomerate would reveal that the product is comprised of particulate. PO Resp. 13-16. Without credible explanation, Encap in its conclusion limits its final description of an agglomerate to an assemblage of *fine* particles. *Id.* at 16. Evidence cited by Encap that may support this additional limitation is an article by Wolfgang B. Pietsch, titled "The Agglomerative Behavior of Fine Particles." *Id*. at 13-14 (citing Ex. 1020 ¶ 11, Attachment A). As the title suggests, however, the article is specifically directed to agglomerates of fine particles. There is no credible suggestion in Mr. Madigan's Declaration (Ex. 1020) that an "agglomerate" is limited to fine particles. *See* Ex. 1020 ¶¶ 11-17.

Scotts Company appears to accept Encap's description of an agglomerate, but takes exception, as we do, with the limitation to fine particles. Pet. Reply 3-4.

Thus, we determine that an agglomerate is an assemblage of particles adhering to each other. The "agglomeration operation" limitation of claim 7 implies that the claimed "combination seed capsule" has a coating of a composition comprising soil conditioning materials comprised of particulate. As such, to satisfy the limitation of an "agglomeration operation," a reference must disclose a product with the structural limitation of being comprised of particulate, irrespective of the process used to make the product.

C. Anticipation by Roth—Claims 1, 2, 5, 7, 8, 11, 13, and 14

Roth explains that the MAS coating is "solid" after application. Roth, however, does not disclose the soil conditioning materials "being in a solid state at time of coating," because Roth discloses a spray application of a MAS material that is 97.5% to 99.9% liquid with the remainder "solids content." PO Resp. 31-32 (citing Ex. 1003, col. 3, ll. 50-51). While a tiny amount (i.e., 0.1% to 2.5%) of the soil conditioning material is in solid state at the time of coating, as discussed above, this is not enough to satisfy the limitation "in a solid state at time of coating," recited in claims 1 and 7. As such, Scotts Company has not shown, by a preponderance of the evidence, that Roth anticipates 1, 2, 5, 7, 8, 11, 13, and 14.

D. Obviousness over Roth and Lowe—Claims 1-5, 7-11, 13, and 14

Roth teaches the claimed "seed acting as a core or pseudo core" with a "coating of a composition comprising soil conditioning materials," as required by claims 1 and 7. Specifically, Roth describes coating seeds with a methanol treated "sludge" carrier having one or more agricultural chemicals dispersed therein, wherein the source material is "municipal sewage," as required by dependent claims 2, 5, 8, and 11. *See, e.g.*, Ex. 1003, col. 3, ll. 23-26. Roth also discloses that its coating may include a "binder," e.g., polyvinyl alcohol, starch derivatives,

and further may include a fertilizer, as recited in claims 13 and 14. *Id.* at col. 2, ll. 3-5, 48-51; col. 5, ll. 49-52. Thus, we determine that Roth discloses all the limitations of claims 1, 2, 5, 7, 8, 11, 13, and 14 with the exception of "in a solid state at time of coating," as required by independent claims 1 and 7.

Lowe discloses coating a seed with de-inked paper sludge having a "fiber content of the solids in the mixture should exceed at least 10%-15% by weight," thereby teaching "in a solid state at time of coating." Ex. 1004, col. 3, ll. 17-21. Lowe also discloses using "agglomeration" to combine the fibers to form individual granules. *Id.* at Abstract; col. 3, ll. 21-22. Thus, as discussed in greater detail below, Lowe in combination with Roth satisfies the limitations of independent claims 1 and 7 as the combination involves the use of known components for their known purpose to achieve a predictable result.

Lowe further teaches coating a seed with a material that is a byproduct of a "paper making process," and specifically that the byproduct is "paper sludge," as required by dependent claims 3, 4, 9, and 10. Lowe describes an agricultural granule for carrying and releasing agricultural chemicals that resembles a clay-based granule. *Id.* at Abstract. The agricultural granule is made from using waste materials from paper manufacture, referred to as paper sludge. *Id.* at col. 1, l. 68–col. 2, l. 1; col. 2, ll. 40-44.

Scotts Company asserts that because Roth teaches a MAS carrier for agricultural chemicals that can coat a seed, and because Lowe likewise teaches an agricultural carrier consisting of paper sludge, a person of ordinary skill in the art would have had reason to substitute Lowe's paper mill sludge for Roth's MAS coating. Pet. 57.

Encap asserts that the proposed combination runs contrary to the disclosure of Roth. PO Resp. 43. In particular, Encap asserts that Lowe requires the fiber content of the finished particle be above 10%, which means, therefore, that the material is 90% or less filler. *Id.* (citing Ex. 1004, col. 4, ll. 65-66; col. 6, ll. 53-63). On the other hand, Roth discloses MAS that is 97.5%-99.9% liquid. *Id.* (citing Ex. 1003, col. 3, ll. 50-51). Encap asserts that a product that is 97.5% or more liquid could not be replaced by a product with 10% or more fiber content and still be sprayed. *Id.* (citing Ex. 1020 ¶ 22). We do not find Encap's argument persuasive because Roth is not limited to spray-on coatings. The MAS, and presumably Lowe's paper sludge, can be applied to the seeds "by dipping, soaking, spraying, or other conventional mode of application." Ex. 1003, col. 4, ll. 48-50.

Encap also asserts that Roth's disclosure of a coating with 0.1% to 2.5% solids teaches away from using Lowe's coating containing over 10% solids. PO Resp. 43. Roth, however, "does not criticize, discredit, or otherwise discourage" the use of a higher percentage of solids. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). Thus, Encap's argument is not persuasive.

Encap further asserts that paper sludge and MAS have very different characteristics. PO Resp. 44-45. In particular, Encap asserts that attempting to coat a seed with paper sludge, using the agglomeration process disclosed in Lowe, would not have a reasonable likelihood of success. *Id.* at 46. In support of its assertion, Encap submits the Declaration of Mr. Madigan (Ex. 1020) who testifies as to the difficulties associated with coating seeds with paper sludge utilizing the agglomeration process of Lowe. *Id.* We do not credit Mr. Madigan's declaration as it fails to provide the underlying basis for his conclusions. For example, Mr. Madigan cites an attachment that purports to show what a final product of Lowe

would look like if seed is introduced into the agglomeration process of Lowe. Ex. 1020, ¶ 23 and Attachment 5. Mr. Madigan, however, does not provide sufficient details regarding the underlying testing upon which he appears to rely. 37 C.F.R. § 42.65. Further, Scotts Company combined the paper sludge of Lowe (not its agglomeration process) with Roth. *See*, *e.g.*, Pet. 57.

As to Encap's assertion that Roth in view of Lowe does not disclose a "combination seed capsule," as discussed above, the preamble recitation "combination seed capsule" is not an additional structural limitation on the claim. PO Resp. 47.

Lastly, Encap asserts that Lowe's paper sludge is not a "soil conditioning material." *Id.* (citing Ex. 2007 ¶ 19). Paragraph 19 of Mr. Katers' Declaration, however, does not support Encap's contention. Mr. Katers merely states that "[n]ot all paper sludge material would benefit the soil to which it is applied;" he does not state that Lowe's paper sludge is not beneficial to the soil. Ex. 2007 ¶ 19.

We, therefore, conclude that the ordinary artisan would have combined Roth and Lowe to arrive at the claimed composition.

E. Anticipation by Schreiber—Claims 1, 7, and 13

Schreiber discloses the limitations of claims 1 and 7. For example, Schreiber discloses a plant seed having multiple coatings thereon, which satisfies the claimed "seed acting as a core or pseudo core." Ex. 1002, col. 1, ll. 4-6; col. 9, ll. 38-43. Schreiber further discloses the claimed "coating of a composition comprising soil conditioning materials." Specifically, Schreiber describes a seed coating made of a composition comprising solid particulate coating material, such as ground peat moss, thereby satisfying the claimed "being in a solid state at time of coating," of claims 1 and 7. *Id.* at col. 2, ll. 34-49; col. 10, ll. 40-42. Schreiber

explains that its invention permits the tailoring of seed coatings for achieving optimum germination and growth, while allowing early planting within a wide time period. Schreiber also explains that other advantages also accrue from the invention. Schreiber, thus, satisfies our construction of "soil conditioning materials" because its coating provides better root development and drought resistance. *Id.* at col. 2, ll. 15-19; col. 9, ll. 44-49. Schreiber also discloses that the coating is an "agglomeration" of a plurality of types of materials, as Schreiber explains that the coating composition includes a "binder," required by claim 13, or a plasticizer, and that the coating layers may coalesce, thereby satisfying the agglomeration requirement of claim 7. *Id.* at col. 2, ll. 37-39, 55-56; col. 3, ll. 35-42; col. 6, ll. 23-32.

Encap asserts that Schreiber does not disclose a "combination seed capsule." PO Resp. 18-23. For the reasons discussed above, a "combination seed capsule" found in the preamble of claims 1 and 7 does not further limit the claim. Encap also asserts that Schreiber does not disclose a "soil conditioning material." *Id.* at 23-26. Schreiber, however, discloses peat moss, limestone, gypsum, and vermiculite. Ex. 1002, col. 2, ll. 44-49. Those materials are known to beneficially modify the soil in some way other than direct provision of plant nutrients, and are, thus, "soil conditioning materials," as recited in claims 1 and 7. *See, e.g.*, Exs. 1028-1031. Encap's expert, Mr. Baker, acknowledged that peat moss, limestone, gypsum, and vermiculite are all soil conditioning materials. Baker Depo., Ex. 2005, 88, l. 22– 90, l. 9.[8]

[8] We reference page numbers found in the lower right corner of the exhibit.

Encap seeks to distinguish Schreiber on a purported difference in the function of the Schreiber coating and those disclosed in the '259 patent. Specifically, Encap asserts that Schreiber discloses using a water-insoluble coating with a water-soluble binder (e.g., peat moss) to delay germination until growing conditions are favorable, whereas, the soil conditioning materials of the '259 patent enhance germination and plant growth. PO Resp. 25. For the reasons already discussed, the claim limitation "soil conditioning materials" does not require the material also provide soil conditioning value to the seed. Moreover, the '259 patent explicitly discloses that the coating may be used to delay germination. Ex. 1001, col. 4, ll. 12-20; col. 25, ll. 8-17. Just because Schreiber's coating also serves to delay germination does not mean that it is not a "soil conditioning material," so long as it beneficially modifies the soil, in some way other than direct provision of plant nutrients.

In summary, we hold that Scotts Company has shown, by a preponderance of the evidence, that claims 1, 7, and 13 are anticipated by Schreiber, under 35 U.S.C. § 102(b).

F. Obviousness over Schreiber and Roth—Claims 2, 5, 8, 11, and 14[9]

As discussed above, Schreiber discloses the elements of independent claims 1 and 7. Scotts Company proposes using Roth's MAS in place of Schreiber's peat moss. Pet. 38-39. Scotts Company's proposed combination would result in a seed coated with Roth's MAS, and as discussed above, MAS does not satisfy the claim limitation that the soil conditioning material be "in a solid state at the time of coating."

[9] In its Response, Encap references claim 15 instead of 14. We have interpreted Encap's reference as intended to be to claim 14. PO Resp. 26-27.

Therefore, we hold that Scotts Company has not shown, by a preponderance of the evidence, that claims 2, 5, 8, 11, and 14 are unpatentable over Schreiber and Roth, under 35 U.S.C. § 103(a).

G. Obviousness over Schreiber and Lowe—Claims 3, 4, 9, and 10

As discussed above, Schreiber discloses the elements of independent claims 1 and 7. Lowe further teaches a material that is a byproduct of a "paper making process," and specifically that the byproduct is "paper sludge" as required by dependent claims 3, 4, 9, and 10. Lowe describes an agricultural granule for carrying and releasing agricultural chemicals that resembles a clay-based granule. Ex. 1004, Abstract. The agricultural granule is made from using waste materials from paper manufacture, referred to as paper sludge. *Id.* at col. 1, l. 68–col. 2, ll. 1, 40-44. Scotts Company asserts that because Lowe teaches an agricultural granule made from paper sludge for carrying and releasing incorporated agricultural chemicals that resembles a clay-based granule (*id.* at Abstract; col. 2, l. 1), a person of ordinary skill would have had reason to substitute Schreiber's water-insoluble, solid, clay-like, agricultural inner coating material with Lowe's paper sludge materials. Pet. 40.

Schreiber discloses that its inner coating controls permeability of water and is typically water insoluble. Ex. 1002, col. 2, ll. 34-39. Encap asserts that there is no evidence that Lowe's material, derived from paper sludge, would operate to control water permeability (i.e., is water insoluble)—a trait important to the teachings of Schreiber. PO Resp. 28. Scotts Company does not respond to Encap's argument, and fails to provide any evidence that Lowe's agricultural granule is water insoluble. If Lowe's material is water soluble, it would not be a

suitable replacement for Schreiber's inner coating, as it would frustrate Schreiber's objective of delayed germination.

In summary, we hold that Scotts Company has failed to show, by a preponderance of the evidence, that claims 3, 4, 9, and 10 are unpatentable over Schreiber and Lowe under 35 U.S.C. § 103(a).

H. Anticipation by Matthews—Claims 1, 2, 7, 8, 13, and 14

Matthews discloses the claimed "seed acting as a core or pseudo core" with a "solid" "coating of a composition comprising soil condition materials," as required by claims 1 and 7. Ex. 1007, 2, ll. 41-89. Specifically, Matthews describes a seed pellet product coated with "fly ash," as required by dependent claims 2 and 8. *Id.* at 2, ll. 10-12, 61-64. Mathews further describes alternatingly spraying and dusting the seed with the coating until the desired thickness is reached, after which the seed pellets are dried. *Id.* at 2, ll. 81-84, 88-89. Matthews also discloses that the coating is an "agglomeration" of a plurality of types of materials, as required by claim 7, because Matthews explains that the coating of dust particles is bound by an adhesive water-soluble plastic, such as polyvinyl alcohol or methyl cellulose, around and about the original seed particle. *Id.* at 2, ll. 42-45, 50-54; 3, ll. 5-9. Matthews describes applying a "binder," as required by dependent claim 13, to the seed capsule, e.g., polyvinyl alcohol, to hold the coating substances firmly on the seed. *Id.* at 2, ll. 42-45; 3, ll. 5-9. Further, the Matthews seed coating may include "fertilizer," thus satisfying dependent claim 14. *Id.* at 5, ll. 25-27.

Encap asserts that Matthews does not disclose a "combination seed capsule." PO Resp. 38. As discussed above, the preamble recitation "combination seed capsule" does not further limit the claim. In addition, Encap unpersuasively asserts

that Matthews' fly ash may not be necessarily beneficial to the seed (*id.*)—a requirement lacking from our claim construction of "soil conditioning material." Relying upon Messrs. Baker and Katers, Encap asserts that Matthews' fly ash does not *necessarily* modify the soil in a beneficial manner, and hence, has not been proved to be a soil conditioning material. *Id*. at 39-42 (citing Ex. 2011 ¶ 21; Ex. 2007 ¶ 24). Essentially, Encap's argument is that while fly ash is specifically identified in the '259 patent as a soil conditioning material (*see, e.g.*, Ex. 1001, col. 7, ll. 21-25), not *all* fly ash is suitable—indeed, some types of fly ash are toxic. *Id.* Matthews, however, states that "[e]ach material must be stable and non-toxic." Ex. 1007, 8, ll. 9-10. Moreover, Mr. Baker also acknowledged that a person of ordinary skill would have understood that a non-toxic fly ash could be used to coat a seed as a soil condition material, and that using toxic materials harmful to the seed should be avoided. Ex. 2005, 150, l. 18–151, l. 20. Lastly, Matthews also discloses that the use of its coating materials "aid in germination" and "growth of the plant." Ex. 1007, 2, ll. 33-39. Thus, we determine that a person of ordinary skill would interpret Matthews as using non-toxic fly ash, beneficial to the soil.

Matthews also discloses using lime (*id.* at 5, ll. 28-35), which Mr. Krysiak admitted was a soil condition material (Ex. 2002, 148, ll. 18-23).

Therefore, we hold that Scotts Company has shown, by a preponderance of the evidence, that claims 1, 2, 7, 8, 13, and 14 are anticipated by Matthews under 35 U.S.C. § 102(b).

I. Secondary Considerations

Before we can determine that the combination of Roth and Lowe (*see* Section D, above), renders the challenged claims unpatentable as obvious, we must consider the evidence of obviousness anew in light of any evidence of secondary

considerations of nonobviousness presented by Encap. *See Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966) ("Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy."); *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012) ("This objective evidence must be 'considered as part of all the evidence, not just when the decisionmaker remains in doubt after reviewing the art.'") (quoting *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538-39 (Fed. Cir. 1983)).

Encap alleges copying by others, long felt need, and commercial success as secondary considerations of non-obviousness. PO Resp. 48-49. Encap, however, fails to provide sufficient credible evidence to support its allegations.

Encap alleges that Scotts Company's Miracle-Gro® Turf Builder Grass Seed with Water Smart® is a copy of the product of the '259 patent. *Id.* at 48. To support its allegations, Encap submits a copy of marketing brochures for EncapSeed™ products (Ex. 1009, 89-97), a copy of the packaging from Scotts Company's Turf Builder Grass Seed with Water Smart® (*id.* at 98-101; Ex. 2013, 342-43, 346-47), a copy of a website print out pertaining to Scotts Company's TurfBuilder (Ex. 2013, 344-45), a Declaration by Mr. Krysiak dated October 31, 2012 and submitted during an *ex parte* reexamination (Ex. 1009, 118-131), and a Declaration by Mr. Krysiak (Ex. 1022 ¶¶ 41, 42). None of the evidence submitted by Encap, however, demonstrates that Scotts Company's Miracle-Gro® Turf Builder Grass Seed with Water Smart® product falls within the scope of any claim of the '259 patent, that Scotts Company was aware of the '259 patent prior to

developing its product, or that Scotts Company developed its product by copying the '259 patent.

Encap also asserts that there was a long-felt need for invention disclosed in the '259 patent. PO Resp. 48-49. Specifically, Encap asserts that many homeowners could not get their grass seed to grow because of inappropriate watering. *Id*. at 48. Encap, however, presents no credible evidence this need was satisfied by the '259 patented invention.

Lastly, Encap asserts commercial success because Meadowland took a license to the '259 patent. *Id*. at 49. Encap, however, does not allege that Meadowland's licensed product was commercially successful, or that any such commercial success was attributable to the patented features of the product. Encap also asserts that Scotts Company's product was commercially successful. *Id.* Encap, however, does not provide persuasive evidence that Scotts Company's product is covered by any claim of the '259 patent, that such product was commercially successful, or that such success was attributable to the patented feature.

After weighing all the evidence of obviousness and nonobviousness of record, on balance, we conclude that the strong evidence of obviousness outweighs the weak evidence of nonobviousness. For the foregoing reasons, we conclude that Scotts Company has shown, by a preponderance of the evidence, that claims 1-5, 7-11, 13, and 14 are unpatentable under 35 U.S.C. § 103(a) over Roth and Lowe.

J. Encap's Corrected Motion to Amend Claims

Encap filed a Motion to Amend Claims (Paper 24), which was later corrected (Paper 47) ("Mot."). In the Corrected Motion, Encap proposes substitute

claims 15-24, to replace claims 2-5, 8-11, 13, and 14,[10] respectively. Mot. 1. The Corrected Motion is contingent, meaning that a proposed substitute claim is at issue and would be considered only if "the original claims of the '259 patent are found unpatentable." *Id.* While somewhat ambiguous, we interpret Encap's motion as proposing a substitute claim if the claim it replaces is found unpatentable, as opposed to being contingent on all of the challenged claims being found unpatentable. Scotts Company has demonstrated the unpatentability of claims 1-5, 7-11, 13, and 14. Therefore, the contingency has materialized, and thus, we consider the Corrected Motion on the merits.

As the moving party, Encap bears the burden of proof to establish that it is entitled to the relief requested. 37 C.F.R. § 42.20(c). The proposed amendment is not entered automatically, but only upon Encap's having demonstrated the patentability of those substitute claims. Here, we find that Encap has failed to demonstrate that the added limitations distinguish over the known prior art, for example, Roth in combination with Lowe. Hence, Encap's Motion to Amend is denied.

In a conference call on August 26, 2013, we provided Encap guidance on filing a motion to amend the claims, and specifically directed the parties to the analysis in *Idle Free Sys. v. Bergstrom, Inc.*, IPR2012-00027, Paper 26 (PTAB June 11, 2013). The summary of the call is reflected in Paper 17 of the record. *Idle Free* holds that a patent owner should specifically identify features added to

[10] Encap later identifies the substitution as claims 15-24 in place of claims 2-5 and 11-13. Mot. 2-5. Thus, it is unclear whether claims 23-24 are proposed as replacement for claims 13 and 14, or for claims 12 and 13. However, as we discuss below, the issue is moot.

each substitute claim, and come forward with technical facts and reasoning about those features, including construction of new claim terms. *Idle Free*, slip op. at 7. The patent owner should also discuss the "significance and usefulness" of the added features "from the perspective of one with ordinary skill in the art." *Id*. We agree with the reasoning in *Idle Free*, and conclude that Encap has failed to satisfy its burden to demonstrate the patentability of the proposed substitute claims by a preponderance of the evidence.

While Encap identifies nineteen separate "structural limitations," presumed to be new, it does not identify how each of these structural limitations differs from what is previously recited in the claims. 37 C.F.R. § 42.221(b) ("A motion to amend claims must . . . show the changes clearly . . . ."). Specifically, Encap's listing of proposed claims 15-24 does not show, by redline or discussion, how the claims being replaced have been modified. Mot. 1-5. Moreover, Encap fails to construe any new claim limitation, and also fails to proffer any technical facts and reasoning about the amended features. *Idle Free*, slip op. at 7. Encap's failure to comply with the Board's directive places Scotts Company in the unfair position of having to ascertain the claim amendments and then make assumptions about which of the amendments are considered by Encap to be significant. For amended claims, however, the burden "is not on the petitioner to show unpatentability;" it is "on the patent owner to show patentable distinction over the prior art." *Id.* at 7. Encap has not met its burden.

For example, to determine the differences between original claim 2 and its proposed substitute, claim 15, the following comparison was created, with bracketed text indicating material deleted from claim 2, and underlined text indicating material inserted into claim 2 (paragraphing added).

[2] 15. The combination seed capsule of claim 1 wherein [material of said soil conditioning materials are comprised of sludge or fly ash] said combination seed capsules provides cooperative and beneficial effects of said soil conditioning material working together in controlled intimate relation with said seed, to enhance the germination and growth processes of said seed and the plant emergent therefrom, said effects being greater than when said soil conditioning material and said seed are applied to the soil separately; wherein said effects result from an intimate relationship of said soil conditioning materials in said combination seed capsule, whereby said materials cooperate with each other in support of said germination and growth processes;

said soil conditioning material is a material that beneficially modifies soil in some way other than direct provision of fertilizer, used with said seed to provide soil conditioning value to said seed so coated, irrespective of general tilth condition of the growth medium into or onto which the seed capsule is applied;

said solid state at time of coating comprising materials in form of a particulate material, fibrous material, a suspension of said particulate and/or fibrous material in a liquid suspension, or any combination thereof; said soil conditioning value of said soil conditioning material to said seed comprises the enhanced control of moisture about said seed; said enhanced control consists of absorbing and holding water;

said coating of said combination seed capsule comprises a plurality of particles.

Encap does not explain why each new feature is "significant and useful," does not construe any of the new claim limitations, nor proffer any technical facts and reasoning about the amended features. Instead, Encap provides conclusory statements only, such as "Roth does not provide the cooperative and beneficial

effects of this structural limitation." Mot. 6. Encap does not provide a proposed interpretation of the recited "cooperative and beneficial effects" of proposed substitute claim 15, nor does it explain whether Roth provides some of the "effects of this structural limitation," and not others or why.

Encap asserts that the structural limitations themselves provide the technical facts and reasoning, as well as the significance and usefulness of the limitations. Pet. Reply 3. Encap asserts also that the "[c]laim construction of the structural limitations is found within the limitations themselves." *Id.* We disagree. Providing "cooperative and beneficial effects" is vague and not self-defining, in any meaningful way. Consequently, the usefulness and significance of the limitation is not self-evident. The same can be said of, "working together in controlled intimate relation."

Encap also fails to "provide meaningful reasons" for making additional changes to dependent claims. *Idle Free*, slip op. at 9. For example, claim 18, which depends from claim 15, adds three new limitations. *See* Mot. at 3; *see also id*. at 3-4 (claims 19 and 20 both depend from claim 17, and only differ by inclusion of a fungicide in claim 19). But Encap fails to explain why the additional features were added to these dependent claims. *Idle Free*, slip op. at 9-10 ("Adding features for no meaningful reason is . . . not responsive to an alleged ground of unpatentability.").

In addition, *Idle Free* further instructs patent owners to consider and distinguish "prior art," both "of record" and "not of record but known to the patent owner." *Id*. at 7. Moreover, we specifically explained to Encap that "[a] conclusory statement that no prior art is known to the patent owner . . . is insufficient." IPR2013-00110, Paper 17, 2. On page 1 of its Motion (Paper 47),

Encap states, "No closer art than the prior art cited in the underlying *inter partes* review is known to PO." Encap, however, was aware of additional relevant prior art, including Simmons and Evans, which were cited in Scotts Company's request for *inter partes* review, but which were deemed cumulative of the adopted grounds of rejection. *See* Pet. at 41-49; Prelim. Resp. at 25. While those references may have been cumulative over the original claims, they are not be cumulative in view of Encap's proposed substitute claims, and should be addressed. Encap's proposed claim 15 recites that the soil conditioning material "comprises enhanced control of moisture about said seed" consisting of "absorbing and holding water." Encap distinguishes the prior art in this *inter partes* review by arguing that it does not teach enhancing moisture about the seed. Mot. at 9-10. Simmons and Evans specifically disclose coating a seed with a water-absorbable polymer. Yet, Encap failed to distinguish its proposed claims over those two material prior art references.

Encap attempts to correct some of its errors by filing an expert declaration with its Corrected Reply to Motion to Amend. Paper 49; Ex. 2012. As already addressed, however, we exclude this Declaration as untimely and improperly incorporated by reference into Encap's Motion. In addition, as discussed above, the proffered "corrected" Second Declaration of Mr. Krysiak does not overcome Scotts Company's objections, and is thus, excluded.

For the above reasons, Encap's Corrected Motion to Amend Claims is denied as it fails to distinguish over the prior art, for example, Roth in combination with Lowe.

III. CONCLUSION

Scotts Company has shown by a preponderance of the evidence that: (1) claims 1, 7, and 13 of the '259 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Schreiber; (2) claims 1, 2, 7, 8, 13, and 14 are unpatentable under 35 U.S.C. § 102(b) as anticipated by Matthews; and (3) claims 1-5, 7-11, 13, and 14 are unpatentable under 35 U.S.C. § 103(a) as obvious over Roth and Lowe.

Scotts Company has not shown by a preponderance of the evidence that: (1) claims 1, 2, 5, 7, 8, 11, 13, and 14 of the '259 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Roth; (2) claims 2, 5, 8, 11, and 14 are unpatentable under 35 U.S.C. § 103(a) as obvious over Schreiber and Roth; or (3) claims 3, 4, 9, and 10 are unpatentable under 35 U.S.C. § 103(a) as obvious over Schreiber and Lowe.

Encap has not shown by a preponderance of the evidence that its proposed substitute claims 15-24 are patentable over the prior art.

IV. ORDER

In consideration of the foregoing, it is hereby ORDERED that:

> Scotts Company's Motion to Exclude Mr. Krysiak's Second Declaration (Ex. 2016) is granted and all other relief requested in the motion is denied;
>
> Encap's Motion to Exclude Mr. Sundstrom's Declaration (Ex. 1039) is dismissed as moot;
>
> Claims 1-5, 7-11, 13, and 14 of the '259 patent are determined to be unpatentable; and
>
> Encap's Corrected Motion to Amend Claims is denied.

This is a final decision. Parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2013-00110
Patent 6,209,259

Petitioner:

Robert Schulman
rschulman@hunton.com

Jeff Vockrodt
jvockrodt@hunton.com

Patent Owner:

Philip Weiss
weissandweiss@aol.com

Aaron Olejniczak
aarono@andruslaw.com

US006209259B1

(12) **United States Patent**
Madigan et al.

(10) **Patent No.: US 6,209,259 B1**
(45) **Date of Patent: Apr. 3, 2001**

(54) **SEEDING TREATMENTS**

(75) Inventors: **Daniel Paul Madigan**; **Michael Dennis Krysiak**; **Ronald Dean Eichhorn**; **Glen H. Wesenberg**, all of Green Bay, WI (US)

(73) Assignee: **Encap, LLC**, Green Bay, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/113,254**

(22) Filed: **Jul. 10, 1998**

Related U.S. Application Data

(60) Provisional application No. 60/052,287, filed on Jul. 11, 1997.

(51) **Int. Cl.**[7] **A01K 1/06**; A01K 21/00
(52) **U.S. Cl.** **47/57.6**; 47/58.1
(58) **Field of Search** 47/65, 65.5, 74, 47/57.6, 58.1

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Primary Examiner—Bruce R. Campbell
Assistant Examiner—Anne Marie Grünberg
(74) *Attorney, Agent, or Firm*—Philip M. Weiss, Esq.; Weiss and Weiss PC

(57) **ABSTRACT**

This invention pertains to combination seed capsules wherein each seed capsule includes both moieties of at least one soil conditioner and at least one seed, and optionally, one or more inorganic chemical fertilizer, growth enhancer, binder, and/or anti-fungal agent. The combination seed capsules are made by physically combining the respective soil conditioner and seed with one other, in the absence of any requirement for chemical reactions in the process of so combining the respective materials. The combination seed capsules provide cooperative and beneficial effects of the soil conditioner and the optional inorganic fertilizer, working together in controlled intimate relation with the seed, to enhance the germination and growth processes of the seed, and the plant emergent therefrom, greater than when the soil conditioner and seed, and optionally inorganic chemical fertilizer, are applied to the soil separately; the improvement being a result of the intimate relationship of the respective materials in the combination seed capsule, whereby the respective materials cooperate with each other in support of germination and plant growth.

14 Claims, 6 Drawing Sheets

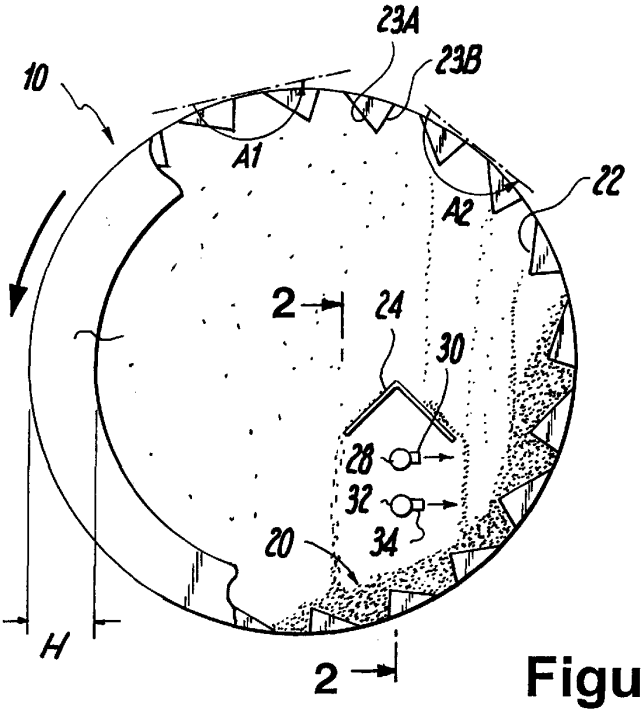


Figure 1

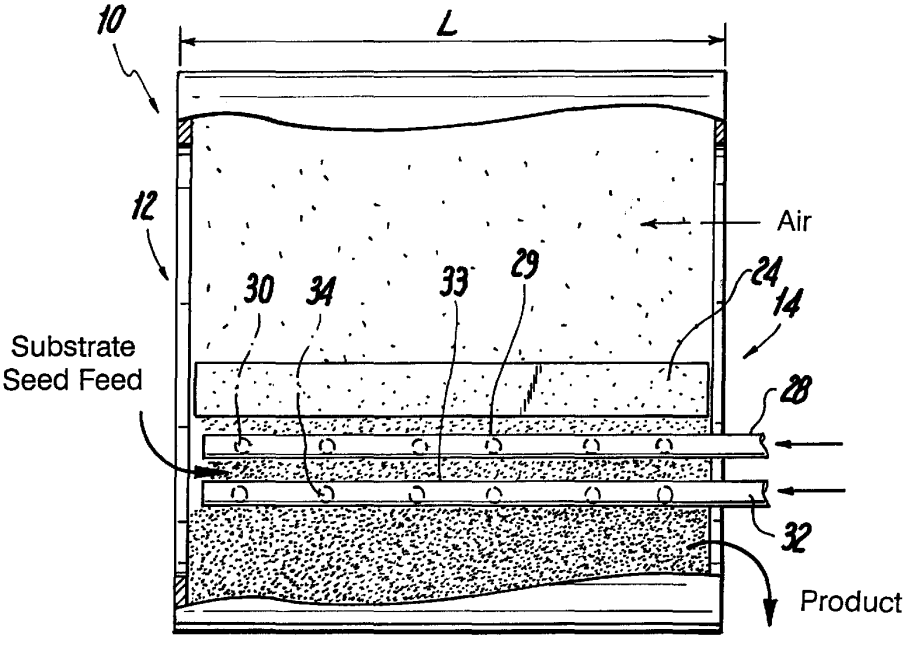


Figure 2

Figure 3

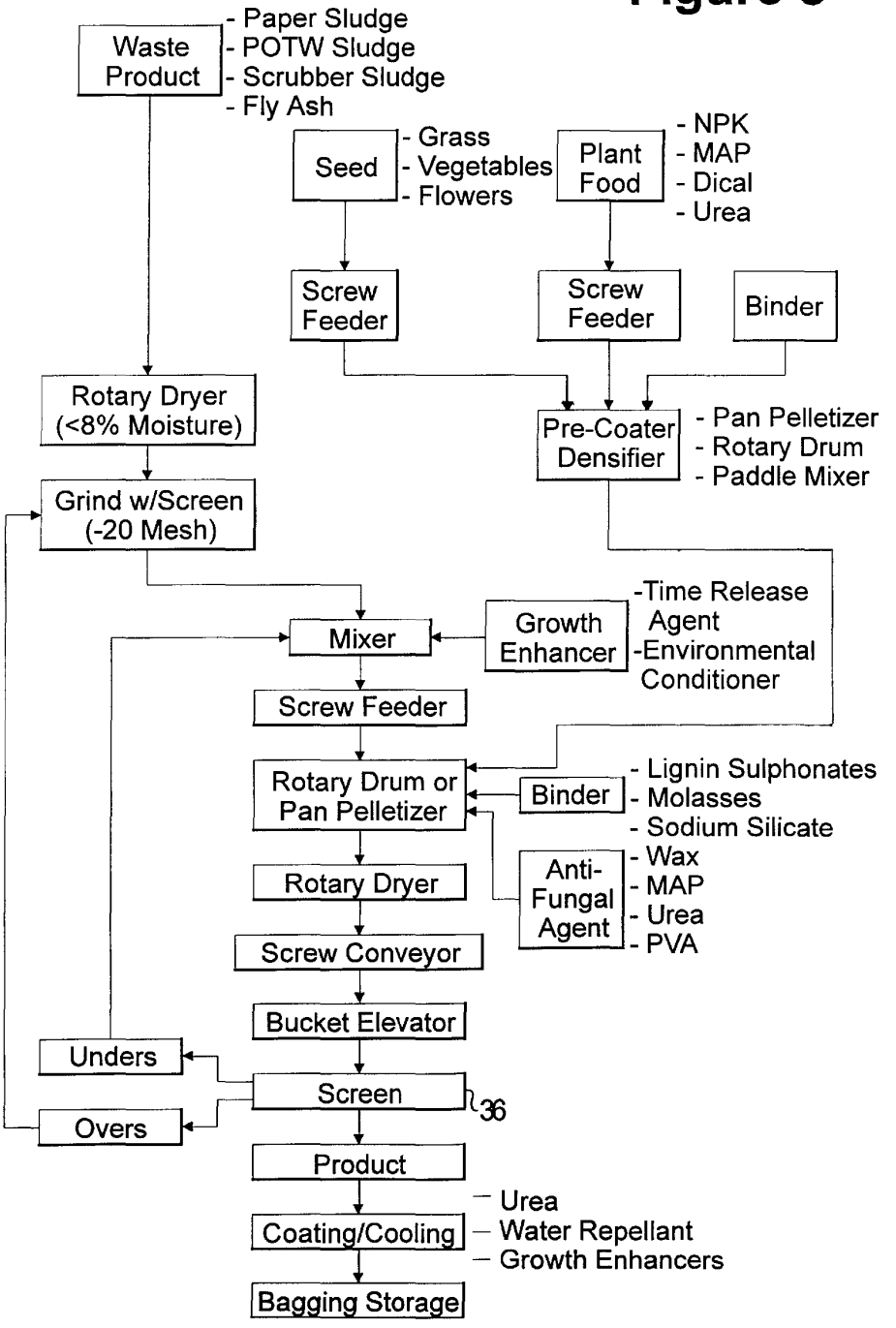
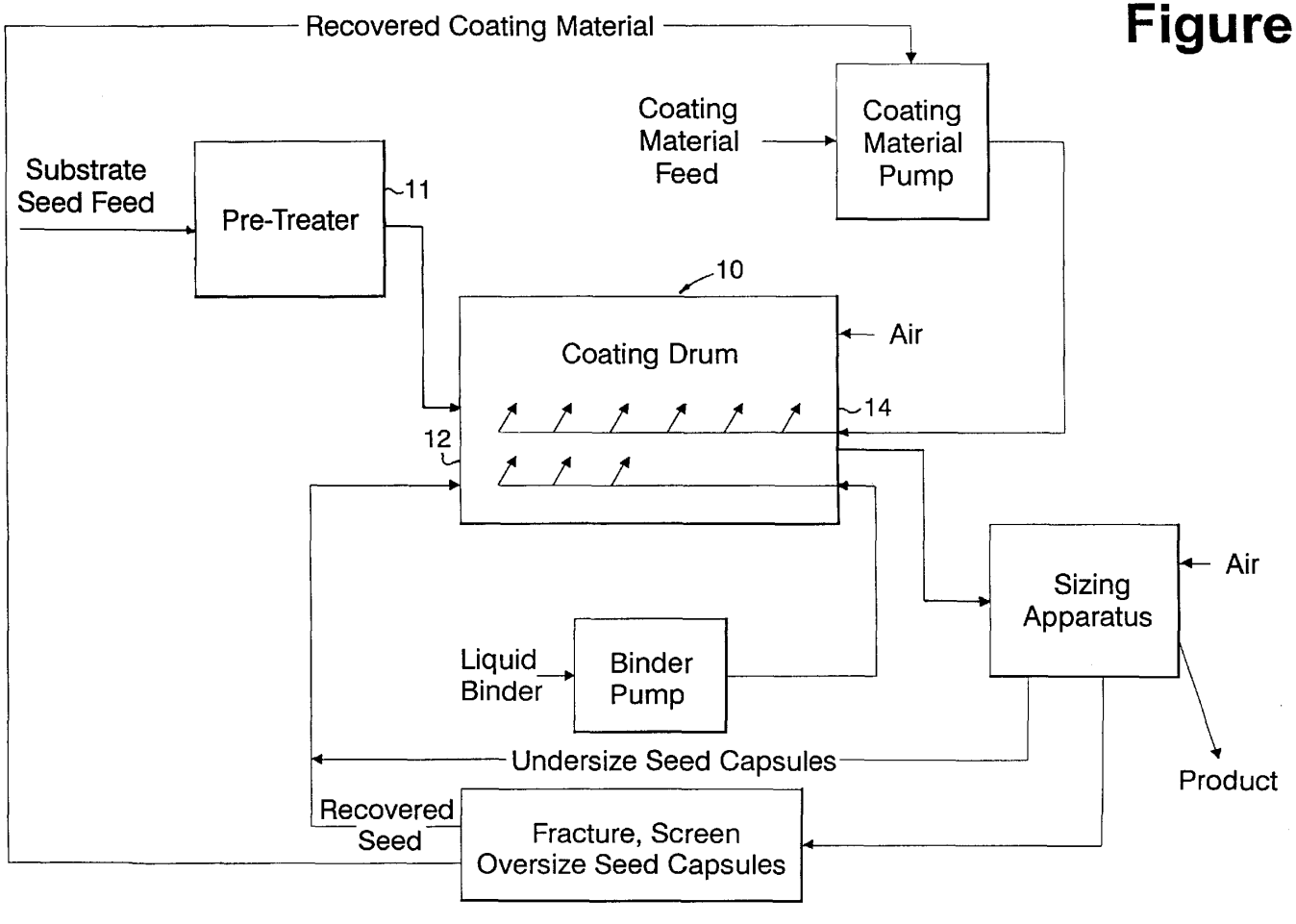
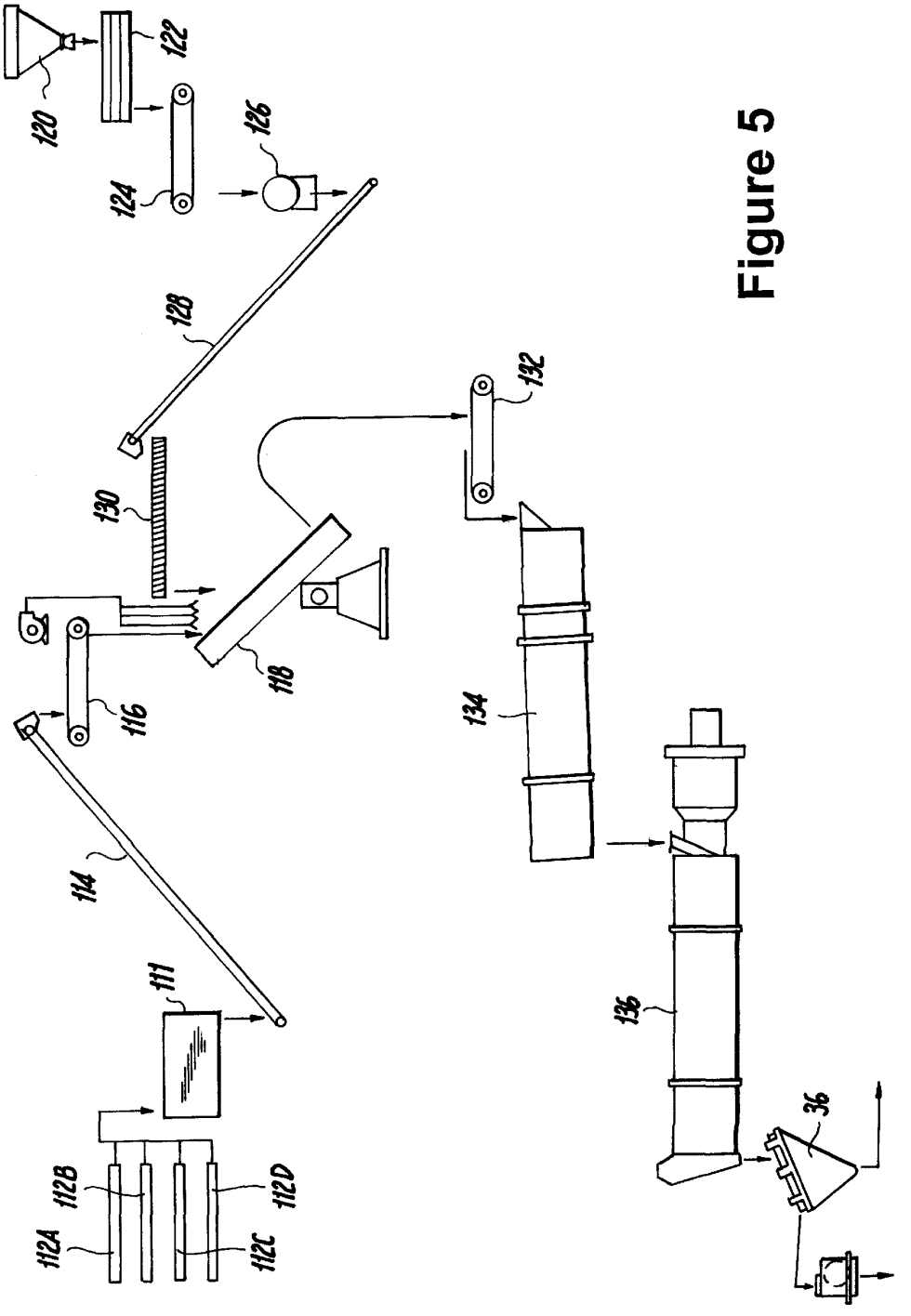

Waste Product
- Paper Sludge
- POTW Sludge
- Scrubber Sludge
- Fly Ash
Seed
- Grass
- Vegetables
- Flowers
Plant Food
- NPK
- MAP
- Dical
- Urea
Screw Feeder
Screw Feeder
Binder
Rotary Dryer (<8% Moisture)
Pre-Coater Densifier
- Pan Pelletizer
- Rotary Drum
- Paddle Mixer
Grind w/Screen (-20 Mesh)
Mixer
Growth Enhancer
-Time Release Agent
-Environmental Conditioner
Screw Feeder
Rotary Drum or Pan Pelletizer
Binder
- Lignin Sulphonates
- Molasses
- Sodium Silicate
Anti-Fungal Agent
- Wax
- MAP
- Urea
- PVA
Rotary Dryer
Screw Conveyor
Bucket Elevator
Unders
Screen
36
Overs
Product
Coating/Cooling
- Urea
- Water Repellant
- Growth Enhancers
Bagging Storage

Figure 4


Recovered Coating Material
Coating Material Feed
Coating Material Pump
Substrate Seed Feed
Pre-Treater
11
10
Coating Drum
Air
14
12
Sizing Apparatus
Air
Liquid Binder
Binder Pump
Undersize Seed Capsules
Product
Recovered Seed
Fracture, Screen Oversize Seed Capsules


120
122
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136
36
111
112A
112B
112C
112D
114
116
118

Figure 5

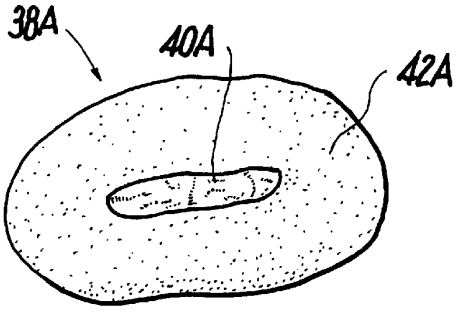

Figure 6A

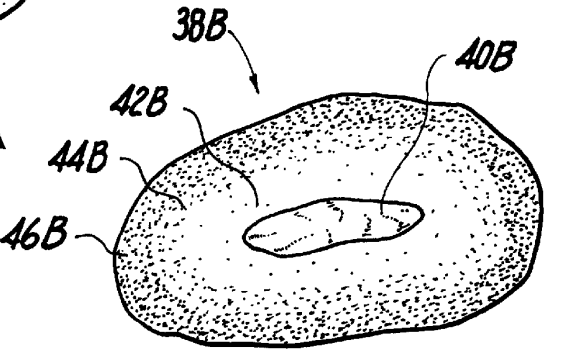

Figure 6B

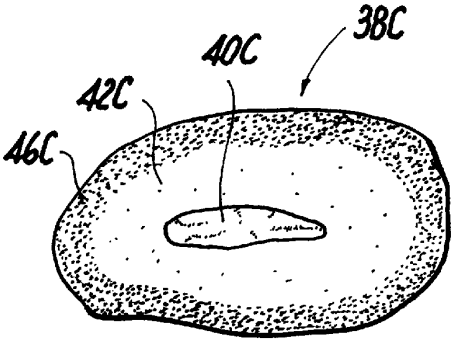

Figure 6C

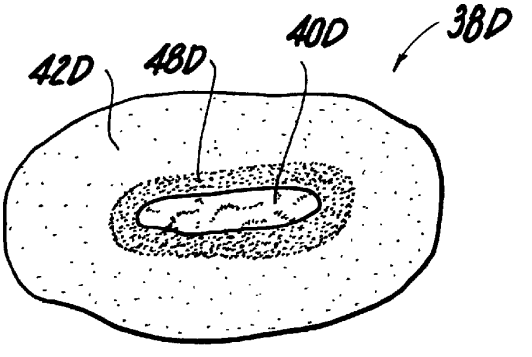

Figure 6D

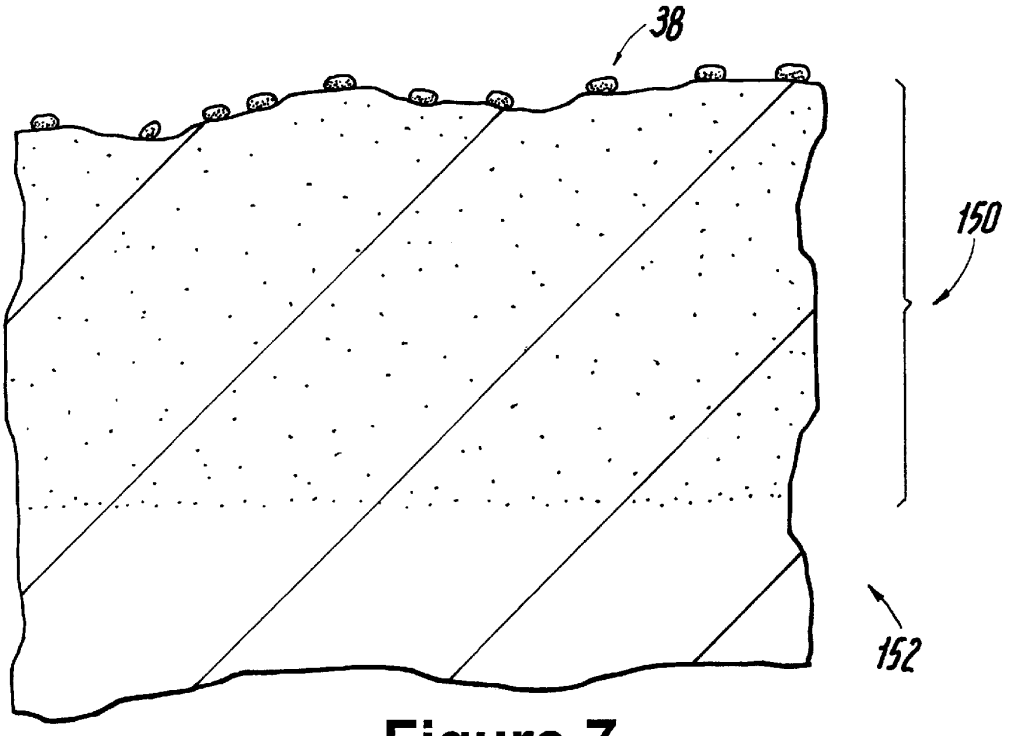

Figure 7

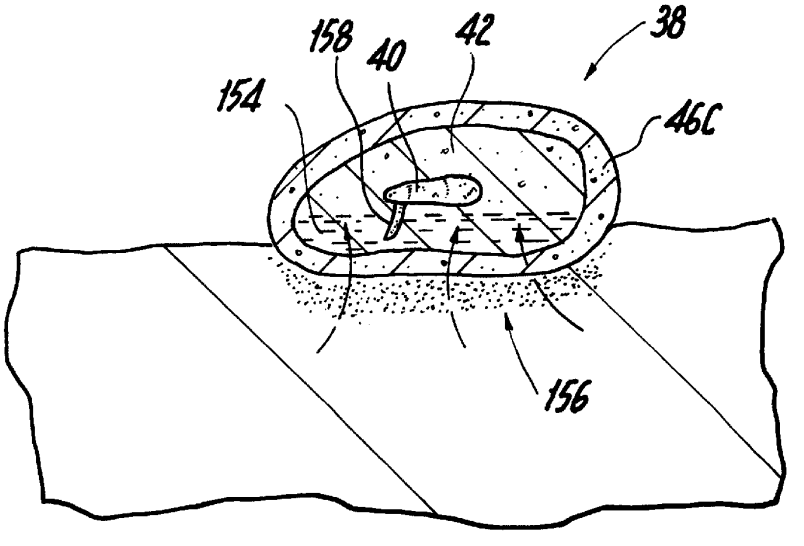

Figure 8

SEEDING TREATMENTS

This application claims benefit to U.S. provisional No. 60/052,287 filed Jul. 11, 1997.

FIELD OF THE INVENTION

This present invention relates to improvements in seed and seed-related products, processes for making such products and processes for establishing and improving seed beds and seed bed germination. As additional benefits, this invention is directed at improving soil productivity through enhancements in soil fertility, soil condition/tilth, and control of soil moisture. Further, the invention relates to productive use of certain types of abundantly available manufacturing waste, which waste is currently being disposed of in landfills.

BACKGROUND OF THE INVENTION

Agricultural growers, gardeners, landscape operators, flower growers, and the like produce a wide variety of cultivated crops. Many such crops are grown from seed. The sizes, shapes, and physical characteristics of the various kinds of seeds are as varied as the number of crops produced therefrom.

Producers of such cultivated crops encounter a variety of challenges in handling and distributing such seed, as well as with sowing of such seed in suitable growing media. Certain seed may desirably be sowed by a broadcast method if the seed were compatible with broadcast application. For example, grass seed for lawns is desirably broadcast, but the low density and generally non-aerodynamic shape of some grass seed can limit the range of such broadcast, and make such seed susceptible to being blown about by wind, or washed away by surface water, even if initially well placed in a good seeding application.

Another difficulty encountered in sowing seed is that the seed may be so small as to be difficult to handle, thereby to place properly-spaced seeds at a desired spacing as to make cost-effective use of the seed, thereby to produce a crop of the related plants without using any more seed than necessary, thus to gain maximum benefit from the amount of seed used.

While small seed may be efficiently handled by industrial equipment especially designed for handling such seed, typically the user of such seed also handles various other types of seed; and may be unable to justify the cost of such specialty seed-handling equipment. Rather, the seed user typically has a limited range of seed handling equipment which must be capable of being used and/or adapted to handle and apply all the types of seeds being used by that user. Where the seed itself can be adapted to the equipment, specialty seed can be handled without need for any specialized equipment.

Even where the seed may be sown by hand, such as in seedling or bedding trays or pots, some seeds are so small as to be difficult for the sower/user to effectively manipulate and control by hand. Typical of such difficult-to-handle seeds are seeds of lettuce, carrots, the cabbage family, ground cherries, and alfalfa. Many flower seeds are equally small and/or difficult to handle and/or manipulate, for example poppy seed.

When seed is planted, the seed has immediate use for moisture to aid in germination of the seed, and subsequent early development of the resulting young plant. Where moisture is not readily available to the seed when planted, the seed may lie in a dormant state for some period of time before germinating. While the seed is thus dormant, awaiting suitable moisture, the seed is subject to a variety of hazards which may destroy its viability. The seed may be attacked by worms, parasites, and other pests. The seed may be eaten by foraging animals including insects and larvae. The seed may be overheated by a hot sun. The seed may lie dormant without germinating for so long that any plant emerging therefrom will have insufficient time to mature before the end of the growing season.

If and when the seed does germinate, the seedling plant has a continuing need for a proper balance of moisture and oxygen, as well as for such plant nutrients as nitrogen, phosphorous, and potash, as well as the micronutrients, in relatively predictable quantities. To the extent the proper balance of such materials is available to the young plant, a healthy young plant may be produced, with optimum potential for maximum crop production, assuming germination occurs at a seasonably-desirable time.

To the extent one or more such materials is not available to the seed and/or the young plant, plant growth, plant health, and ultimately maturity, may be adversely affected. For example, the soil may be too dry to support germination, or optimum germination. Or while the soil may in general have a desired moisture content, moisture content at a macro level can vary widely. Thus, while the soil in general may have a desirable moisture content, the microcosm of the soil adjacent an individual seed may be too dry, or too wet, to support any germination, or optimum germination.

Similarly, the soil may be generally depleted of one or more plant nutrients needed by the germinated seedling. Or while the soil may in general have desired nutrient levels, the nutrient levels at a macro level can vary widely. Thus, the microcosm of the soil adjacent an individual seed may be too low in one or more nutrients to support a desired level of plant growth, or so high as to be toxic to a desired level of plant growth.

Further, plant nutrient chemicals may be present in the soil, but so tied up chemically in the soil as to be unavailable, or poorly available, relative to the quantities and use rates needed for desired plant growth. Or the soil may become so hard, dry, and/or caked shortly after the seed germinates that the seedling plant has difficulty penetrating such soil, difficulty becoming associated suitable nutrients, and/or difficulty taking up such nutrients because of insufficient moisture availability.

After the plant has further developed such that the plant roots extend deeper into the soil, conditions of the soil near the surface are less critical. However, until such time as the roots so penetrate, conditions of the soil at and near the top surface of the soil may be critical.

Soil fertility generally relates to uptake of plant nutrients from the soil by plants. Uptake is generally the result of two factors, the presence of plant nutrients in the soil, and the availability of the plant nutrients for plant uptake. Presence of plant nutrients in the soil is generally a function of the combination of (a) the basic level of soil fertility, (b) depletion by previous crop production and (c) replenishment with fertilizer. Availability of a plant nutrient physically present in the soil for plant uptake is in general related to solubility of the respective nutrient or nutrient combination in a solvent for the nutrient, which solvent is present in the soil, such solvent as water, along with any other material affecting solvation of the plant nutrient into the water or other solvent.

Plant nutrients are routinely depleted from the soil by crop production, and are routinely added back, or otherwise replenished, to the soil by conventional inorganic fertilizers.

In order for plant nutrients in the soil to be available for uptake by plants, the nutrients must be held in the soil without excessive leaching, but must not be held so tightly that the nutrients cannot be released for plant uptake. Thus, nutrient availability requires a balance between holding tightly enough to retain the nutrient in the root zone, without leaching, but not so tight as to make the nutrient unavailable for plant uptake. Thus, the general "condition" or "tilth" of the soil is instrumental in determining the efficiency with which plant nutrients are utilized for plant nutrition.

A properly conditioned soil has advantageous soil chemistry in combination with advantageous soil texture. Thus, in addition to providing specific plant nutrients, soil users also use products that modify basic soil chemistry, and soil texture.

Basic soil chemistry is modified by adding to the soil, for example, calcium products to provide pH control, and flyash or like products to provide pH control as well as micronutrients.

Soil texture is generally modified by adding to the soil organic matter such as manures, sludges, wood and other plant products and by-products, and the like. While such materials have good soil conditioning properties, plant nutrient value of such materials is fixed and is generally so low that other "fertilizer"-type products must in general be used in addition to the organic matter in order to preserve plant nutrient values in the soil.

The primary object of this invention is to provide solid plant seed capsule products that supply both soil conditioning properties and the seed, which can benefit from such conditioned soil, in a given seed capsule particle.

It is a further object to provide a plant nutrient material, in the seed capsule particle, in amount beneficial to the seedling emerging from the seed, and higher than a naturally-occurring amount of such nutrient in such soil conditioning material, so as to have enhanced chemical nutrient qualities over use of the soil conditioning material alone.

In another aspect, a further object is to provide soil conditioning and optionally nutrient qualities to seed products that reach the soil as the result of fulfilling objectives separate from providing soil fertility or soil conditioning.

Still another object is to provide seed capsules containing fertility-enhancing elements having a high level of plant food nutrients in combination with a high level of soil conditioning properties.

Still another object is to encapsulate a seed in a soil conditioning material using materials rich in plant nutrients as part of the encapsulating agent.

Yet another object is to provide a seed product which reduces the tendency for light weight seeds to be washed away by surface water runoff.

Still another object is to provide a seed product which obviates the typical practice of adding straw as a mulch over e.g. grass seed, to protect the seed from being washed away by surface water, from heat of the sun, and to hold moisture in the soil.

A further object is to provide products wherein a single seed capsule product particle provides enhanced soil texture and enhanced soil nutrient value at nutrient levels traditionally needed by newly-germinated seedlings, optionally with higher levels of plant nutrient suitably spaced from the seed itself so as to not be toxic to seedling growth, optionally in combination with time-release technology.

Yet another object is to provide fertility-enhancing seed capsule products having a suitable level of plant food nutrients in combination with a high level of organic matter as soil conditioning material.

SUMMARY OF THE INVENTION

The invention generally addresses a combination seed capsule, comprising at least one viable seed, having an outer surface and acting as a core or pseudo-core of said combination seed capsule; and a coating of a composition comprising a soil conditioning material mounted proximate, including disposed outwardly of the outer surface of said seed.

In general, the coating provides at least one of (i) enhancing broadcast flight properties of the combination seed capsule; (ii) reducing susceptibility to deleterious affects of weather on the combination seed capsule; (ii) enhancing resistance of the combination seed capsule to attack by animals, weeds, or spore-formers; (iv) staged germination of ones of the seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in the seeds; (v) enhancing control of moisture about the seed thereby to assist in seed germination; (vi) release of plant nutrients into soil onto which the combination seed capsule is placed; (vii) soil conditioning effect to soil onto which the combination seed capsule is placed; (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released; (ix) higher embryo emergence and survival rate in a population of the seed capsules, thereby reducing required seed planting density for a desired plant population density; and (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

While a wide variety of seeds may be used, in general such seeds are selected from the group consisting of grass, vegetables, grains, and flowers.

Preferably, the coating comprises the soil conditioning material in combination with at least one ingredient effective to reduce susceptibility of the seed capsule to deleterious affect of at least one of animals, weeds, and spore-formers. In some embodiments, the ingredient for reducing such susceptibility of the seed capsule is selected from the group consisting of herbicides, fungicides, for example metalaxyl, and a bitter substance.

In some embodiments, the combination seed capsule further comprises a second coating, separate from the first coating, and comprising at least one ingredient effective to reduce susceptibility of the seed capsule to deleterious effect of at least one of animals, weeds, and spore-formers.

Some embodiments are effective to provide a plant nutrient at a desirable controlled distance from a plant seedling emerging from the seed, in an amount beneficial to the plant seedling.

In other embodiments, the second coating material is intermingled with the first coating material in an outer portion of the first coating, and generally displaced from the seed.

The second coating material can comprise a plant nutrient, beneficial in location and in amount of availability, to a plant seedling emerging from the seed. The second coating composition can comprise an inorganic form of a plant nutrient and can be selected from the group consisting of nitrogen, phosphorus, and potassium. The second coating composition can comprise urea or an inorganic form of a plant nutrient and can be selected from the group consisting of e.g. monammonium phosphate, diammonium phosphate,

superphosphate, triple superphosphate, dicalcium phosphate, and potash or a nutrient such as sulfur, manganese, copper, boron, iron, magnesium, or chromium.

A population of the seed capsules can comprise coatings having a range of properties affecting germination rate of the seeds, thereby to stage germination of the seeds in the population over a period of time longer than the range of germination times inherent in uncoated ones of the seeds. Such properties can be, for example, a range of hardnesses, or a range of thicknesses, of the coatings.

The coating can comprise a first layer of the soil conditioning material, and a second layer comprising an inorganic, and/or organic, fertilizer, and/or at least one nutrient, such as, for example, sulfur, manganese, copper, boron, iron, magnesium, or chromium.

A preferred soil conditioning material is a sludge composition, such as a fiber-containing by-product of a paper making operation, or sewage sludge.

The seed capsule can comprise a water-leachable plant nutrient, and/or a leach-retardant composition, such as wax, effective to retard leaching of the leachable plant nutrient out of the combination seed capsule.

In some embodiments, in a population of the combination seed capsules, the coatings in ones, but less than all, of the population, comprise ingredients effective to retard effective penetration of a seed-germinating environment to the seed for germination thereof.

In embodiments preferred for some applications, the seed capsule comprises an inner layer on the outer surface of the seed, and an outer layer, the inner layer enhancing properties of the seed for acting as nucleus in an agglomeration operation agglomerating the coating onto the inner layer.

In some embodiments, the coating comprises an admixture of the soil conditioner and a plant nutrient.

In preferred embodiments, the coating remains generally disposed about the seed, and preferably but not necessarily remains generally intact about the seed, until the seed germinates.

The invention further comprises a plant growing medium extending over an area, the plant growing medium having a root zone, and a top surface of the root zone generally corresponding with a top surface of the plant growing medium, the plant growing medium having a first overall soil condition and texture; and a population of seed capsules disposed over the top surface of the plant growing medium, the seed capsules comprising individual seeds, having outer surfaces, and coatings of soil conditioning material disposed outwardly of the outer surfaces of the seeds, the coatings of the seed capsules providing localized germination and growth environments, at and adjacent the seeds, having texture, and nutrient and water holding properties for supporting seedling health, superior to respective properties as provided overall in the root zone of the plant growing medium.

The invention yet further comprises a method of providing plant micronutrients to soil, the method comprising placing onto the soil a population of combination seed capsules, each comprising at least one seed, and a coating comprising a plant nutrient material.

The coating can comprise a first coating comprising the plant nutrient, and a second coating, separate and distinct from the first coating, and comprising a soil conditioning material.

The invention yet further comprehends a method of providing a seed bed having enhanced growing conditions for growing seed, the method comprising coating a population of the seeds with a coating material, and thereby providing coatings thereon of such material, the material tending to stabilize, in the seed capsules, or in soil on which the seed capsules are disposed coating compositions which tend to hold, moisture adjacent the seeds in the seed capsules or in soil adjacent the seed capsules, in such quantities and for such times as to enhance growing conditions for the seeds; and placing the population of seeds on soil effective to support germination of the seeds which are in the seed capsules.

In some embodiments, the seed capsules comprise inner layers on the outer surfaces of the seeds, and outer layers, the inner layers enhancing properties of the seeds for acting as nuclei in agglomeration operations agglomerating the coatings onto the inner layers.

The invention yet further comprehends a method of making a population of combination seed capsules, each comprising a seed, and a coating of a soil conditioning material, the method comprising pre-coating the seed with a material which enhances the ability of the seed to act as a nucleus in an agglomeration operation, to form a pre-coated substrate; and subsequently coating the pre-coated substrate with a soil conditioning material. A preferred pre-coating material comprises dicalcium phosphate.

In general, the pre-coating step typically results in an overall increase in the density of pre-coated seed combination. The pre-coating step can be accomplished by, for example, spraying the pre-coating material onto the seed, and subsequently driving off such as by drying, as necessary, any solvent or other liquid carrier used for application of the coating material to the seed.

In yet other expressions, the invention comprehends a method of providing an enhanced seed germination environment in combination with placement of a controlled amount of plant nutrients in controlled proximity to each seed, the method comprising providing a population of seeds, coated with a soil conditioning material which tends to enhance germination of the seeds, and with plant nutrient composition effective to enhance growth of plant embryos emerging from the seeds; and placing the population of seeds on soil effective to support germination of the seeds. In such method, the coating material can include a second ingredient comprising plant nutrient moieties.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a transverse cross-sectional view of a coating drum suitable for spray-coating substrate seed according to the present invention.

FIG. **2** is a partially cut away view showing a length of the drum of FIG. **1**.

FIG. **3** is a schematic representative flow diagram illustrating a first manufacturing process for producing combination seed capsule product of the invention.

FIG. **4** is a block diagram illustrating a second manufacturing process for producing combination seed capsule product of the invention.

FIG. **5** is a schematic representative flow diagram illustrating a third manufacturing process for producing combination seed capsule product of the invention.

FIGS. **6**A, **6**B, **6**C, and **6**D show cross sections of seed capsules of the invention.

FIG. **7** illustrates a cross-section of the soil root zone, and a representative population of seed capsules at the top surface of the soil.

FIG. **8** illustrates a single seed capsule on the soil surface, and the micro-environment developing about the seed capsule.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

The following is a detailed description of the illustrated embodiments of the present invention which provides combination seed capsule products that provide for a combination of efficient and proper seed placement in the soil, soil conditioning properties at the specific site of the seed, plant nutrients at or near the specific site of the seed, ingredients effective to reduce deleterious effects of spore-formers and animals, and/or other various physical benefits/properties of the combination seed capsule not previously available in a single product.

In general, at least one seed substrate and at least one soil conditioning material are selected as raw materials, and are combined to make a combination soil conditioning seed capsule product of the invention.

The invention can operate with any of a wide variety of soil conditioning materials such as municipal or other sewage sludge, scrubber sludge, paper mill sludge, fly ash, dust, animal waste, other organic materials, and mineral soil conditioning materials.

The soil conditioning material can be a solid material having a melting temperature so high that handling such material in the melt state is impractical and/or undesirable in view of the limited temperatures at which the seed will remain viable. For example, the soil conditioning material may be combustible at a temperature lower than its melt temperature, or will melt only above temperatures which can be tolerated by the seed, such that viability of the seed would be destroyed if melting were attempted in an environment which exposed the seed to such temperatures. Thus, handling such material in the melt state is impractical, whereby other methods of handling the soil conditioning material may be desired.

Solid sewage sludge, sawdust, and solid animal waste are representative of soil conditioning materials which cannot be readily melted. In the alternative, some soil conditioning materials such as sewage sludge, paper mill sludge, sawdust, and solid animal waste can be suitably comminuted and then dissolved or suspended in water or other solvent composition for processing purposes, optionally along with other soil conditioning materials and/or inorganic chemical fertilizer materials, and the solvent subsequently driven off to make a resulting solid product.

Chemical fertilizers generally are distributed in commerce as solid state materials. Such material is generally produced in manufacturing steps either in solution or in the melt state to meet a specified narrow range of size, hardness, and plant nutritional characteristics, distinct to the application of each such product. Examples of such fertilizers include nitrogen, phosphorus, and potassium containing products such as urea, monoammonium phosphate, diammonium phosphate, superphosphate, triple super phosphate, dicalcium phosphate, potash, and the like. The chemical fertilizer can be a mixture or other physical combination of known inorganic fertilizer chemicals, and may include desired amounts of nutrients such sulfur, manganese, copper, boron, iron, zinc, and the like.

In preferred embodiments of this invention, a precursor seed capsule, having one or more coatings of the soil conditioning and/or other material thereon may first be prepared as a solid or semi-solid particle or agglomerate. The soil conditioning raw material may be a particulate powder, or may be fibrous, or may be a suspension of a powder or fibrous material in a liquid carrier, and is preferably coated onto the substrate seed to form a seed capsule or other agglomeration of particles, fibers, or the like. Where the soil conditioning material is, for example, sewage sludge, the sewage sludge raw material can be obtained as a slurry that may be bound together as with a binder, preferably an organic binder, when dried. The slurry may be spray-applied to the substrate seeds, for example to a rolling bed of such seeds, in combination with a flow of air to evaporate water from the thus-applied coating. Such sewage sludge, or paper mail sludge, need not be reacted or otherwise treated with any acid, caustic, or any other chemical before being applied and/or dried, or partially dried, either in preparation for, or after, the slurry application of the sludge to the seed substrate.

Specifically, the sewage sludge or paper mill sludge used herein as soil conditioning raw material need not be treated to transform such sludge into colloidal form. Thus, the sludge preferred for use herein is generally non-colloidal in nature, and is distinguished by its non-colloidal nature from conventional sludges which are specifically treated to provide the colloidal characteristics thereto.

Natural lignin, lignosulfonates, and the like, may serve as suitable binders where the soil conditioning material is, for example, paper mill sludge, raw wood, sewage sludge, or other organic or inorganic material. In the case of, for example, calcium chloride or other inorganic additives, such materials may be added to the primary coating, e.g. onto or into the sludge coating, by well-known processes.

Soil conditioning material used herein may be devoid of such conventional plant nutrients as nitrogen, potassium, and phosphorous, or may have such limited plant nutrient value, or may be so unbalanced in nitrogen, phosphorous, and potassium content, that the soil conditioning material may not, by itself, be a desirably complete material for use as the only ingredient in the seed coating. Thus, such soil conditioning material may have limited application herein where basic level of soil fertility is seriously degraded. However, all soil conditioning materials contemplated herein beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients. By use of soil conditioner in intimate association with the seed, this invention not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated, and in intimate association with the seed, irrespective of the general tilth condition of the growth medium into or onto which the seed capsule is applied.

Further to preferred embodiments, typically a first coating material (e.g. soil conditioning material) is readily converted into liquid state such as liquid suspension, and is provided to the process as a liquid. As a general statement, the first coating material may be sprayed onto the substrate seed, then is converted back to solid state on the thus-created seed capsules or seed capsule precursors. In the alternative, the coating material may be mixed with the seed in an (e.g. ribbon) blender, or may be otherwise coated onto the substrate seed in an agglomeration process according to well-known conventional agglomeration principles.

Regarding the coating process, the coating Material can accumulate as a single or multiple layer coating on the outside of the seeds to form a population of combination seed capsules. The layer or layers of coating material can be

a homogeneous or heterogeneous mixture of the desired elements. Further, such population of combination seed capsules can have a range of hardnesses and thicknesses for improved seeding treatments.

Cooperating inner and/or outer layers may be used e.g. to control direct contact between the seed and moisture. Suitable materials and processes therefore are taught in U.S. Pat. No. 3,698,133 Schreiber and U.S. Pat. No. 4,759,151 Gerber, and are thus well known in the art.

In some embodiments, a second coating material may penetrate into the layer of soil conditioning coating material. Such penetration may comprise a generally uniform distribution of the second coating material throughout the first coating material, or may represent a more stratified or otherwise heterogeneous distribution of second coating material in or on the first coating material.

In other embodiments, the coating materials may be mixed into a heterogenous layer. Such layer or layers of heterogenous material can then be coated upon the outside surface of the seed.

Where the liquid state of a coating material was obtained by slurrying or otherwise combining the coating material with water, the liquid fraction is reduced after application of the liquid-state material to the substrate seed, or to the growing seed capsule, to effect solidifying of the coating material after application of the coating material to the substrate seed. The liquid fraction is reduced by driving off the liquid carrier, as by medium or low temperature air, or vacuum or other flash drying, after or during application of the coating material to the substrate seed. The resulting solid seed capsule, comprising the seed coated with the e.g. sludge coating material, is then recovered as a combined soil conditioning seed capsule product of the invention.

Spraying of the liquid coating material can be accomplished by a variety of known processes such as, but not limited to, pneumatic, hydraulic, or electrostatic spraying processes. The temperature and pressure of the material being sprayed depends on the material selected, and the viscosity and other parameters of the respective material in the respective liquid state. While high atomization is desired, such is not critical. The liquid coating material need only be atomized sufficiently to provide a generally uniform coating on the substrate seeds, as determined after the coating and solidification steps in fabricating the seed capsule product are completed.

Indeed, the uniformity of coating or coating thickness about the seed is typically not critical so long as the seed is not on or immediately adjacent an outside surface of the capsule such that the seed may fall out, or be easily broken out, of the capsule, or easily removed by dissolution of materials at and near the surface of the seed capsule. In addition, the seed should not be so near the outside surface of the capsule as to be in a nutrient layer having such high concentration of nutrient as to be toxic or otherwise detrimental to viability or growth of a plant emergent from the seed.

Spray application of the coating is suitably controlled to achieve the required addition of the spray material, liquid and/or powder, coating to the substrate seed or precursor seed capsule. An illustrated method of applying the liquid material to the substrate seed or precursor seed capsule is by using a rotating drum spray-coating apparatus. Other apparatus and methods, for example a tilted pan coating process, can be used to apply the soil conditioning material and optionally an chemical fertilizer material onto the substrate seed. The coating operations can be batch operations or continuous operations.

As illustrated in FIGS. **1**, **2**, and **4**, spray apparatus can operate within a rotating drum disposed in a generally horizontal orientation. The drum may incorporate internal lifting flights which lift free-flowing (e.g. seed and growing seed capsule) particles in the drum and then let the particles fall to the bottom of the drum as a continuously falling curtain or cascade. In some embodiments, the interior of the drum is either clean and free from any flighting, or has only mixing fingers or flights that expand the area covered by the bed, that keep the bed rolling as the drum rotates, and that generally improve mixing, rather than lifting particles to the top of the drum and then releasing them in a falling cascade. However, such lifting of particles to the top of the drum, and corresponding falling cascade or falling curtain, are not excluded from processes of the invention. Rather, both such finger mixing, and such lifting coupled with falling cascade or curtain, are included within the scope of the invention.

Stationary spray nozzles are positioned within the drum to project the sprayed material onto the rolling bed, and optionally onto any curtain or cascade of falling particles. For a continuous process, the drum is preferably inclined at a small angle from horizontal, such as, without limitation, about 0.25 inch to about 0.38 inch from the horizontal for each foot of length of the drum, so that rotation of the drum causes the particles to move from the inlet end of the drum to the discharge end, while maintaining a relatively uniform bed thickness. The optimum degree of incline varies with each set-up and may thus be outside the above range. The important parameter is that the incline contribute to maintaining a bed of seed and seed capsule particles having sufficient uniformity that the spray material can be effectively applied to the particles passing through the drum. The particles are then discharged at the discharge end of the drum.

FIGS. **1** and **2** show schematically a first embodiment of processing equipment which may be used to produce seed capsules of the invention. Such processing equipment includes a drum and sprayer combination suitable for continuously producing coated seed capsules in accord with the invention. Use of the illustrated drum and sprayer combination is not critical, however, as other drum and sprayer combinations, or other coating methods such as pan coating methods, are also suitable. Referring to FIGS. **1** and **2**, drum **10** has an inlet end **12** for receiving the substrate seed material or materials, or partially formed or pre-coated seed capsule precursors. Drum **10** has a discharge end **14** through which agglomerated or otherwise coated seed capsule product particles are discharged over discharge retaining ring **16**. A variable speed rotary drive (not shown) is provided for supporting and rotating the drum **10** in a counterclockwise direction as viewed in FIG. **1** at controlled, and changeable drive speeds. Conventional slope adjustment apparatus (not shown) is provided for routine and ongoing adjustment the slope of the drum from horizontal.

Air is preferably supplied from discharge end **14** as shown in FIG. **2**, and flows countercurrent to the direction of travel of the seed substrate material. Since the contemplated coating materials are generally applied to the seed in liquid, or semi-liquid, or other moist form, and since some coating materials may thus tend to form clumps or otherwise self-agglomerate when exposed to ambient moisture conditions, air supplied at discharge end **14**, and elsewhere in the process for contact with the coated seed and seed capsules, is preferably dried in order to cost-effectively remove an optimum amount of the moisture from the coating material and to assist in maintaining suitably low moisture content in the thus coated and dried seed capsules.

A first stationary spray assembly **28** extends longitudinally within drum **10** above and adjacent the bed **20** of seed and/or seed capsules. First spray assembly **28** includes pipe **29** and nozzles **30**. A second spray assembly **32** extends longitudinally within drum **10** generally adjacent first spray assembly **28**. Second stationary spray assembly **32** includes pipe **33** and nozzles **34**, which transport the material to be sprayed. Nozzles **30** and **34** are connected to pipes **29** and **33** respectively, and project sprays of liquid or otherwise particulate coating material toward the bed of seeds and/or seed capsule precursors. The description of spray assemblies **28**, **32** as stationary means that the spray assemblies do not rotate with drum **10**. However, the positions of either nozzles **30**, **34** or pipes **29**, **33**, or both, can be adjusted within the drum for proper direction of the respective spray or sprays onto the bed of seeds and/or seed capsules or seed capsule precursors.

A stationary protective cover **24** is mounted over the spray assemblies. Seeds and/or seed capsules falling from the inner surface of the drum and the flights, above the spray assemblies, fall onto the cover, and are deflected away from the spray assemblies, as shown in FIG. **1**. Thus, cover **24** protects the pipes and nozzles from the falling seeds and seed capsules falling onto and fouling the pipes and spray nozzles.

As drum **10** rotates, flights **22** lift and mix the seeds, seed capsule precursors, and seed capsules, but do not generally carry the bulk of the seeds and seed capsules up to the top of the drum. Some small amount of seeds, seed capsule precursors, and seed capsules will be carried upwardly to the top of the drum by even a drum devoid of any flights. Thus, all drums experience some amount of seeds and seed capsules falling from the upper part of the rotating drum whereby cover **24** is beneficial for protecting spray assemblies **28** and **32**.

Preferred flights **22** are primarily directed toward enhancing mixing of the bed **20** of seeds and seed capsules, continually refreshing the surface of the bed with a newly-emergent supply of seeds and seed capsules, rather than lifting and subsequently dropping the seeds and seed capsules which may be fragile when initially coated. To that end, each flight **22** preferably, but without limitation, has a leading surface **23**A extending at an obtuse angle "A1" of at least 90 degrees with respect to the inner surface of the drum. A more preferred angle "A1" is about 100 degrees to about 150 degrees. Trailing surface **23**B of flight **22** can be virtually any angle, with the inner surface of the drum, which angle does not interfere with the operation of adjacent leading surfaces **23**A.

Additional retaining rings can be added to the assemblage shown in the drawings, in order to provide that height "H" to the retaining ring which will provide and maintain the optimum configuration of bed **20** inside drum **10**.

As noted above, inlet end **12** of the drum may be raised above discharge end **14**. When in use, the drum rotates continuously. Seeds or previously thinly-coated or partially-coated seed capsules are continuously fed into inlet end **12** and thus added to rolling bed **20**. Flights **22** continuously mix the bed as the drum rotates, refreshing the bed surface with newly fed seeds, or seeds and seed capsules newly brought to the surface by the continuous rotation of the drum in combination with the mixing action of the flights. Spray assembly **28** sprays the desired coating material (e.g. sewage sludge, paper mill sludge, or other coating composition, onto the continuously moving and mixing surface of bed **20** from a plurality of nozzles **30** distributed along the length of pipe **29**, and similarly along the length of drum **10**, adding the sprayed material to the seeds and seed capsules in bed **20**. After receiving the spray coating from spray assembly **28**, the seed capsules are discharged through discharge end **14**. In some embodiments, the seed capsules pass through a cooling chamber, not shown, integral in drum **10**, before being discharged through discharge end **14**.

In general, as the seeds traverse the drum, from inlet to discharge, nozzles **30** atomize the liquid or other coating material and spray such atomized coating material as e.g. droplets of the coating material onto the seeds in the bed. The result is that the seeds become generally uniformly coated with one or more layers of the coating material such that the coating material becomes an integral part of the respective seed capsules fabricated in the drum. As the coating material solidifies on the seeds, the coating material tightly bonds to the respective portions of the seeds.

As the seeds and seed capsules roll and mix with rotation of the drum, the incline of the drum causes the seeds and seed capsules to travel from inlet end **12** toward discharge end **14**.

In the alternative, or where a coating material is not readily self-bonding to the seed material, a binder material can be provided toward the inlet end of the drum at spray assembly **32**, through pipe **33** and nozzles **34**. In such embodiment, the binder is preferably sprayed onto the seeds closer to inlet end **12** rather than along the entire length "L" of the drum. The coating material is then preferably sprayed onto the seeds downstream from the inlet end, and preferably relatively downstream of nozzles **34**. Thus, the seeds receive a first coating of the binder, and a subsequent second coating of e.g. liquid soil conditioning coating material overlying the binder.

Binder material applied as e.g. through spray assembly **32** may contain additional coating components such as e.g. flyash, lime, gypsum, or the like, as one or more components for assisting in adding bulk and thickness to an inner binder layer prior to any, or the majority of, the application of the organic coating material (e.g. sewage sludge or paper mill sludge).

In some embodiments, binder and liquid soil conditioning coating material are applied at similar locations along length "L" of the drum whereby binder and soil conditioning coating material may become intermingled/mixed before reaching the seeds, or on the seeds. For example, liquid soil conditioning coating material may be sprayed onto the seeds along the full length of the coating chamber in drum **10** while spraying of the binder material onto the substrate seeds is done relatively closer to or adjacent the inlet end of the coating chamber of the drum. Thus, a first binder layer may underlie or be mixed with the soil conditioning coating material, and may be overlain by a second layer of the soil conditioning coating material. Thus, in this embodiment, the binder layer may typically be a combination of binder material and coating material.

Further, it is contemplated that the soil conditioning coating may be applied first, followed by application of binder or inorganic fertilizer or sealer coating, in which case the binder or inorganic fertilizer or sealer may serve as an outer shell, temporarily trapping the inwardly-disposed materials inside the seed capsule. In the alternative, the soil conditioning coating may be applied first, followed by application of the binder, and wherein the binder penetrates through the soil conditioning coating, either physically or chemically, to the underlying substrate seed and there provides the binding property.

Additional spray assemblies can be provided, spraying additional materials (e.g. inorganic fertilizer materials) onto the substrate seed. Thus, e.g. 6 spray assemblies can spray 6 different coating materials onto the substrate seed. For example, a first spray material can be a binder or primer material intended primarily to enhance bonding of subsequent sprays to the substrate seed. Continuing the example, a second spray can be a combination of binder and finely comminuted particulate material such as lime and/or flyash. A third spray may be a soil conditioning material such as a paper mill sludge or a municipal sewage sludge. Fourth, fifth, and/or sixth sprays can add nitrogen, phosphorous, and/or potassium plant nutrient ingredients, alone or in combination, or as combinations. In this manner, the soil conditioning properties of the seed capsule can be established, and the plant nutrient level of the seed capsule can be enhanced to provide substantially any level of major and/or minor plant nutrients desired in the seed capsule, at substantially any relative ratios of the respective plant nutrients, and wherein the preferably primarily soil conditioning coating provides desired soil conditioning properties in the resulting product, initially for use by the specific seed contained therein, and ultimately as additive to the overall tilth of the growth medium such as soil into or onto which the seed capsule is eventually planted.

A preferred, and rather simplistic, embodiment of the invention is provided by spraying a soil conditioning liquid suspension of sewage sludge or paper mill sludge onto seeds to be encapsulated to make seed capsules. By controlling the amount of the soil conditioning sludge, or by controlling the residence time of the seeds in the drum, a desired thickness of soil conditioning coating can be provided in the resulting coated product.

Typical dried sewage sludge, as a raw material, contains about 2–6% nitrogen, up to about 2% phosphorous, and generally no potassium, and thus has little or no market value as a fertilizer (plant food) product per se. However, by adding e.g. urea, the nitrogen content can be raised if desired, especially as a coating on or adjacent the outside surface of the seed capsule, whereby the combination fertility-enhanced, soil conditioning, seed capsule product has real market value as a comprehensive, self-contained, value-added, seed capsule product. Such product thus contains the seed, a soil conditioning composition which operates somewhat as a seed incubator providing a beneficial germination environment, and a starter quantity of fertilizer selected in quantity and placed in location so as to provide improved, ideally optimum, amounts of plant nutrients at optimum location for use by the newly-emerged embryonic plant at the germination stage of seed development.

Starting with a sludge coating having 2% by weight nitrogen, sufficient urea may be added to bring the nitrogen content to, for example, 5%, 7%, 8% or 10% nitrogen, or more, depending what analysis is desired. Starting with a sludge coating having 6% nitrogen, sufficient urea may be added to bring nitrogen content to, for example, 10%, or whatever other analysis is desired. Phosphorous and/or potassium components and/or materials having combinations of plant nutrient elements (e.g. NPK) can, similarly, be added to the sludge, either before, after, or during addition of the urea. In addition, nitrogen, potassium, and/or phosphorous-containing materials can be combined with the sludge prior to the sludge being applied to the seed.

It should be understood that the more porous the established soil conditioning coating, or e.g. the outer surface of such coating, the more any subsequent spray material penetrates the established coating. All such penetration is contemplated in use of the term "coating" herein.

In some preferred embodiments, the overall coated combination seed capsule product comprises seed capsules wherein substantially the entirety of the soil conditioning material is confined to a contiguously-defined portion of the seed capsule. In such embodiments, the structures of the finished product seed capsules comprise coatings of contiguously arranged elements of the soil conditioning material, generally arrayed entirely or substantially entirely about the seed, which coatings may be overlain by an additional layer, optionally discontinuous, of organic or inorganic chemical fertilizer. Further coating layers of either soil conditioning material or organic or inorganic chemical fertilizer can be applied over the additional layer.

In addition, or in the alternative, other layers of other materials whether soil conditioning materials, organic or inorganic fertilizers, or other materials, can be applied to the substrate seed before applying the above mentioned layer of soil conditioning sludge. Thus, the substrate seed can be coated with a layer of a calcium compound e.g. calcium chloride, calcium carbonate, or dicalcium phosphate, or with a sulfur moiety, and/or a further layer of urea, all with optional use of binder materials.

Further to the structure of the seed capsules of the invention, the coatings on the seed capsules need not generally represent a uniform mixture of the inorganic chemical fertilizer and the soil conditioner. Rather, in a typical seed capsule a core substrate seed is overlain or encapsulated by a soil conditioning material, and is generally free from a second overlying soil conditioning coating material, and wherein the inorganic fertilizer content at the seed/coating interface is relatively higher so as to represent a second coating material such as an inorganic fertilizer coating, as compared to the inorganic fertilizer content at locations at and adjacent the seed.

The second coating can, and preferably does, in some embodiments, penetrate into voids or other interstices in an underlying e.g. soil conditioning coating. However, preferably most if not all elements of the underlying e.g. soil conditioning coating material are generally interconnected with each other without intervening coating material of the second layer, except for an optional binder used to hold the first coating material together as a unitary structure, separate from any structure and bonding provided by the second coating material.

While the combination seed capsule can comprise discontinuities in the soil conditioning sludge coating layer, in combination with an inorganic fertilizer material in such seed capsules, such compositions are less preferred.

Regarding the coating process, FIG. **4** illustrates in flow sheet form a manufacturing process for producing seed capsules of the invention, using the coating drum **10** as described above. It should be understood, however, that other equipment such as a pan pelletizer, a paddle mixer, or the like can be used in place of the rotary drum to obtain combination seed capsules of the invention.

The coating process operates according to conventional and generally well known agglomeration principles, as described by Wolfgang B. Pietsch in an article entitled "The Agglomerative Behavior Of Fine Particles." Such coating process uses water and heat, along with physical and/or chemical adhesives and like properties, to bind or agglomerate a plurality of types of particles and/or materials into coated seed capsules, each typically containing an individual seed.

To obtain agglomerates from relatively smaller particles of raw materials, binding forces must act within the indi-

vidual developing agglomerate particles. According to known agglomeration principles, five different binding mechanisms are known to be useful for building agglomerate particles including solid bridges, interfacial attractions and capillary pressure, adhesion and cohesion, attraction between solid particles, and form-closed bonds.

At elevated temperatures, solid bridges can form by diffusion of molecules from one particle to another at the points of contact. Heat can be introduced from an external, secondary source or created during agglomeration by friction and/or energy conversion. Solid bridges can also be built up by chemical reaction, crystallization of dissolved substances, hardening binders, and solidification of melted components.

Capillary pressure and interfacial attraction forces in liquid bridges can create strong bonds that disappear if the liquid evaporates and no other binding mechanisms take over.

Highly viscous bonding media such as tar and other high molecular weight organic liquids can form adhesive and/or cohesive bonds very similar to those of solid bridges. Thin adsorption layers are immobile and can contribute to such bonding together of fine particles under certain circumstances.

Typical short-range forces of the van der Waals electrostatic or magnetic type can cause attraction between solid particles whereby the particles stick together if such particles are sufficiently close to each other. Decreasing particle size clearly favors such attraction between solid particles.

Fibers, little platelets or bulky particles can interlock or fold about each other resulting in "form-closed" bonds.

Now referring to FIG. **3**, in some embodiments of the coating/agglomeration process, it is desirable to pre-coat the seeds prior to implementing agglomeration principles to produce the above described coating of soil conditioning material. Such embodiments comprise light-weight and/or elongate shaped seeds (i.e. grass seeds), or other similar type of seed which may not readily or inherently serve as a nucleating agent in a conventional agglomeration process with the respective soil conditioning material which is desired to be coated on the seed. Pre-coating the grass seed, for example, enhances the agglomeration of paper sludge as a coating material, of binder and/or of other coating substances, by increasing the weight of the pre-coated grass seed and by providing a more filled in, more rounded shape to such long and narrow seeds. The increased weight and more filled in shape of the grass seed enables more effective, more efficient, processing of the seed in coating apparatus such as that illustrated in FIGS. **3** and **4**.

Referring to FIG. **3**, the form and composition of such precoating, when needed, can vary according to the weight, shape, composition, and surface properties of the seeds, and according to the binder, if any, the soil conditioning coating or coating materials to be applied, and any other inorganic or organic coating material to be applied.

The seeds, whether pre-coated or not, are received within the rotary drum where the soil conditioning material is spray coated onto the substrate seeds to obtain combination seed capsules.

Before coating the seeds with a soil conditioner, the organic soil conditioner material (e.g. paper sludge) is preferably processed through a dryer such as a rotary drum dryer, as needed, to reduce the amount of moisture in the organic soil conditioner material to less than about 8% water by weight. Such drying is an essential step where the material is otherwise above the nominal 8% effective water content, to enable grinding the sludge to a size less than US Standard 20 mesh screen, and to prevent the particles from agglomerating with each other. Certain of the coating materials, e.g. fly ash, because of their physical properties, need not be dried before being ground to a suitable size for participating in the agglomeration operation.

The seeds, whether pre-coated or not pre-coated, and the one or more soil conditioners, are received within a mixer where growth enhancers such as time release agents and/or other environmental conditioners may be added to form a combination seed capsule. The thus pre-coated seeds are then received into a pan pelletizer, a rotary drum, or the like, where binders such as lignin, lignosulphonates, molasses, sodium silicate, wax, monammonium phosphate, or urea can be added and thereby coated onto the precoated seeds. Other materials which can be added to the seed capsule at the e.g. rotary drum include anti-fungal coatings such as with metalaxyl fungicide, for example, Apron® and/or Subdue®, available from Novartis, Inc. of Greensboro, N.C.

The such-coated seeds are then passed into a rotary or other dryer in order to obtain a seed capsule containing 5% or less water. The maximum water fraction in the coating can vary according to the composition of the coating material, so long as the resultant seed capsules remain suitably structurally strong and so long as a population of such coated seed capsules remains free flowing in solid condition. The process for fabricating the seed capsules must maintain a temperature sufficiently low that the seeds are not heated so hot that viability of the seeds, for germination purposes, is not dramatically compromised. It is generally preferred that the temperature of the seeds be suitably controlled such that any binder and/or coating material, or other materials applied to the seeds, cool at a controlled rate while bonds form between the seeds, or seed capsule precursors and the one or more soil conditioning and/or other coating materials. Such temperatures of all materials are suitably controlled to avoid decomposition of the respective materials, loss of viability of the seeds, or breakage of seed capsules or seed capsule precursors, or coatings or coating or other materials during such processing. The temperature at the rolling seed bed inside drum **10** generally can range from about 130 degrees F. to up to at least 230 degrees F. for seed residence times up to at least 1 hour. At drum operating temperatures of less than 130 degrees F., drying time can become excessive. At temperatures above 230 F., the viability of the seed may be at risk, depending on the sensitivity of the seed, residence time, and other influential parameters.

The above stated temperature range is illustrative and not limiting, and will vary depending on the seed, the coating materials, and the specific process parameters of a particular coating system and coating operation. Thus, maximum e.g. drum coating temperatures can be less than 130 degrees F. or more than 230 degrees F. However, the stated range is preferred, including all temperatures within such range such as, for example, 150 degrees F., 180 degrees F., 210 degrees F., and the like.

Referring to the drum of FIGS. **1** and **2**, and to the pan pelletizer block in FIG. **3**, the seeds are fed continuously to an inlet as at inlet end **12** of drum **10**. Combination seed capsules, produced as described above, are released from a discharge locus such as discharge end **14** of the drum to a sizing apparatus **36** in which the seed capsules are sized through conventional sizing elements. Suitably-sized seed capsules are discharged from the sizing apparatus as product for distribution. Undersize seed capsules are fed back into mixer as shown in FIG. **3**. Oversized seed capsules are fractured and screened for reprocessing.

The recovered seed product can be further coated with any of the coating materials described above, such as urea or other inorganic or organic fertilizer, and/or with growth enhancers or other desirable materials. Further, other types of coating materials such as water repellents can be coated onto the discharged seed capsules for the purpose of importing additional desirable properties to the seed capsules.

In the process of coating porous organic materials such as sewage sludge or paper mill sludge as is optional in the invention, with a second material which is applied for other than imparting soil conditioning properties, for example an inorganic fertilizer, the general size of the coated seed capsule may be the same after applying the second material (e.g. inorganic fertilizer) as the size of the previously-coated seed capsule, or may be similar in size. Namely, the quantity of coating material added to the seed capsule can be so small as to not materially affect seed capsule size, or the coating material can be received into an e.g. porous interior of the soil conditioning coating of the seed capsule, or both.

It is contemplated that the operation and functions of the invention have become fully apparent from the foregoing description of elements, but for completeness of disclosure, the usage of the invention will be briefly described.

EXAMPLE 1

A coating drum as illustrated in FIGS. **1**, **2** and **4** is used to place a coating of paper mill sludge on grass seed. Raw material grass seed about 4–6 millimeters long and about 0.5–1.0 millimeter thick, is continuously fed to pre-treater **11**, where the seed is blended with powdered lime, powdered flyash, and a lignosulfonate binder, to form partially-developed seed capsules comprising seeds coated with relatively thinner coatings of the recited mixture of coating materials. The partially-developed seed capsules are continuously fed to inlet end **12** of drum **10**, to form a bed **20** of the partially-developed seed capsules. The drum rotates continuously. The rolling of the drum, and the associated mixing affect of the flights, provide a constantly changing top surface of the bed. A paper mill sludge slurry is supplied in pipe **28** at pressure sufficient to atomize the liquid sludge slurry. A liquid sludge slurry is thus sprayed from nozzles **30** onto the top surface of the bed of partially-developed seed capsules, applying a sludge coating on those partially-developed seed capsules which are at the upper surface of the bed at any given point in time.

The resulting seed capsules, of paper mill sludge coated seeds, have a coating of soil conditioning sludge thick enough to make the material a product marketable for its soil conditioning content as well as for the seeds contained therein. Increased levels of nitrogen and/or other plant nutrients can be added by, without limitation, providing sprays of the other desired materials, preferably subsequent to at least the initial sludge slurry spray. Other materials can be included in one or more of the sprays e.g. to retard or enhance moisture permeation into or out of the combination product in accord with the anticipated storage and/or use environment of the product.

EXAMPLE 2

FIG. **5** illustrates the equipment used in this EXAMPLE 2. As seen therein, grass seed, lime, flyash, and calcium lignosulfonate binder are fed to ribbon blender **111** by respective screw feeders **112**A, **112**B, **112**C, **112**D respectively. Ribbon blender **111** encapsulates the seed with a thin layer of the mixture of lime, flyash, and lignosulfonate to thereby make partially-formed seed capsules. The partially-formed seed capsules are discharged from the ribbon blender and conveyed by conveyor **114** and belt feeder **116** to a tilted-pan pelletizer **118**, which rotates about a fixed axis.

Paper mill sludge is received into a weigh hopper **120** at about 60% by weight water, and is fed by screw feeder **122** and belt **124** to pin mixer **126**. The pin mixer breaks down the fiber and fiber clusters of the sludge into loose separate fibers, and discharges the resultant material onto conveyor **128** which transports the material to screw feeder **130**, and thence into the tilted pan pelletizer.

In the tilted pan pelletizer, the partially-formed seed capsules, (seeds being coated with lime, flyash, and lignosulfonate) are mixed with the comminuted paper mill sludge and thereby coated with the sludge. By operation of the tilted rotating pan pelletizer, the larger seed capsules generally rise to the top of the bed of seed capsules in the pan, and as additional material (sludge and partially-formed seed capsules) are added to the pan, the larger seed capsules overflow the lower edge of the rotating pan, onto vibrating feeder conveyor **132**. The vibrating feeder conveyor feeds the seed capsules into granulator **134** (e.g. rotating drum) where the seed capsules may be (e.g. spray) coated with inorganic fertilizer or other desired material.

From the granulator, the seed capsules flow into dryer **136** and are dried to a final product moisture of about 2–3% by weight water. The resultant product is then screened and sized as before, with undersized and oversized product seed capsules being recycled for further processing.

Urea and other liquid chemical fertilizers can, as indicated, be used as binders to bind together soil conditioning coatings which are not readily self-bonded together. In such embodiments, the urea or other liquid fertilizer composition serves as the binder or glue which holds together the soil conditioning material which is used as the coating. Other binding materials may be used either alone or in combination with the chemical fertilizer. Any plant nutrient components of the binder/glue composition contribute to the plant nutrient value, e.g. nitrogen, phosphorous, and/or potassium, provided by the so-made seed capsules. Thus, a binder/glue, or a multiplicity of binders/glues, properly selected as to nutrient value can provide, in the finished product, significant contribution to any desired fertility analysis.

A primary purpose of soil conditioning products is to condition the soil in terms of properties other than direct provision of plant nutrients.

The primary purpose of conventional inorganic chemical fertilizer products is to directly provide plant nutrients. It is well known that highly purified forms of inorganic chemical materials are more concentrated than desired in close or intimate proximity with seed, in the growing medium. Thus, inorganic chemical fertilizers can be diluted in concentration and still have sufficient nutrient content to be highly useful additives in soil conditioning seed capsules of the invention. It is common practice to modify and thus dilute inorganic chemical fertilizer products with filler materials that do not provide plant nutrients, in order to provide less concentrated fertilizer products. To the inventor's knowledge, such diluents, however, do not include soil conditioning products, especially not organic soil conditioning products.

It is conventionally known to apply commercially available soil conditioning materials and inorganic fertilizers, in separate applications, to a given common plot of soil to assist the soil in growing a crop. For example, it is known to make a first broadcast or other placement of lime to control pH of the soil, followed by a second broadcast and/or

row-applied placement of granular inorganic chemical fertilizer. It is also known to make sequential applications of a soil conditioning material such as fresh or aged manure followed by inorganic fertilizer, all of which may be separate from the step of applying seed. And where seed is indeed applied in the same step, the seed and soil conditioner are not intimately bound in controlled positioning with respect to each other in common in individual particles of the product so applied, as in the invention.

To the inventor's knowledge, it is not known to apply soil conditioning material and inorganic chemical fertilizer in a common carrier/particle. Nor is it known to apply seed in a seed capsule wherein the seed is intimately combined with a soil conditioning material in a common particle, optionally with an inorganic fertilizer component in controlled positioning with respect to the seed in the same capsule as a seed-soil conditioning particle.

In those embodiments of the invention comprehending both soil conditioning and inorganic fertilizer in the same seed capsule/particle, the ratio of soil conditioning material to inorganic chemical fertilizer material can vary, from, for example, about 80% by weight up to less than 100% by weight soil conditioning material, with corresponding greater than 0% up to about 20% by weight inorganic chemical fertilizer. Generally, the invention as practically applied, however, is somewhat more narrowly defined, because the practical benefits of the invention are achieved at more balanced combinations of the soil conditioning material and the inorganic chemical fertilizer.

Thus, a preferred amount of soil conditioning material is about 90% by weight to about 98% by weight soil conditioning material, in combination with about 2% by weight to about 10% by weight inorganic chemical fertilizer. To the extent the soil conditioning material is present in amount less than about 80% by weight, the corresponding 20% by weight organic fertilizer in such close and intimate proximity to the seed may be toxic to the seed. To the extent the inorganic fertilizer is present in an amount of less than 2% by weight, the beneficial fertility affects of the fertilizer may not be perceived.

To the extent the inorganic fertilizer can be confined in a layer displaced from the seed, a higher level of inorganic fertilizer may be used while limiting risk of a toxic response from the seed. Referring now to FIGS. **6**A–**6**D, in the embodiment of FIG. **6**A, seed capsule **38**A comprises a seed **40**A coated with a single generally homogeneous coating **42**A. Coating **42**A, as illustrated in FIG. **6**A, may comprise only the soil conditioning material (e.g. paper mill sludge or sewage sludge), or may comprise both the soil conditioning material and an inorganic fertilizer or other inorganic material generally dispersed in coating **42**A.

In FIG. **6**B, seed capsule **38**B comprises a seed **40**B coated with a first layer **42**B of soil conditioning material. A second coating material is shown penetrated part-way through the first layer **42**B, thus to make a combination outer layer **44**B comprising the combination of the material of layer **42**A and the material of the second material, such as inorganic fertilizer.

In FIG. **6**C, seed capsule **38**C comprises a seed **40**C coated with a first layer **42**C of soil conditioning material. A second generally separate and distinct layer **46**C of a second coating material (e.g. inorganic fertilizer) is disposed outwardly on the underlying first layer **42**C. Layer **46**C generally does not penetrate layer **42**C, whereby higher levels of inorganic fertilizer may be used because of the effective displacement distance between the seed and the second layer **46**C. The second layer may be prevented from penetrating the first layer by applying e.g. an intervening layer which repels the second layer, for example wax, lignin, or the like.

In FIG. **6**D, seed capsule **38**D comprises a seed **40**D coated with a pre-coating layer **48**D of dicalcium phosphate to densify and configure the seed capsule precursor for the primary coating steps in drum **10** or pan pellitizer **118**. Layer **42**D of soil conditioning material is disposed outwardly of pre-coating layer **48**D. Other materials such as at layers **44**B or **46**C can be added to any of the embodiments, including that of FIG. **6**D to provide the properties associated therewith.

In alternative embodiments, seed capsules can comprise a seed coated with at least one heterogenous layer. The heterogenous layer comprises at least two different materials substantially commingled, uniformly or non-uniformly, within a single layer. Such materials can include, for example, soil conditioning material and inorganic fertilizer, nutrients, herbicides, fungicides, binders and/or any other layer material contemplated by the present invention.

While the soil conditioning material/sewage sludge or paper mill sludge may contain a nominal amount of nitrogen and lesser quantities of phosphorous, potassium, and micronutrients, these small levels of plant nutrient content are generally not high enough for the plant nutrients to be considered a primary commercial asset. Yet only small nutrient amounts are desired so close to the seed. Thus, in some uses, the nutrient content of the sludge may be fully acceptable as the sole coating material on the seed in making suitable and acceptable seed capsules of the invention.

Products of the invention offer a new combination of properties, namely readily available excellent soil conditioning properties in combination with the seed in a seed capsule wherein size and density of the seed capsule are controlled to the desired size and weight.

One of the properties offered by soil texture conditioners such as sewage sludge and paper mill sludge is that of maintaining soil condition by retaining moisture in the soil, retarding leaching of soil nutrients from the root zone, and attenuating hardening, clumping, or other hard agglomeration characteristics of the soil, which harder soils are more difficult for plant roots to penetrate than are softer soils. Thus, improving the soil texture condition, soil tilth, increases the efficiency with which plant nutrients are retained and used for plant nutrition, as well as generally improving the environment of the soil to accommodate, and readily receive, root growth.

When soil conditioning materials and plant nutrients are applied separately to the soil, as in the prior art, the ratio of applied plant nutrients to applied soil conditioning material typically varies widely according to variations in the uniformity of the two applications of the two materials. Further, the soil conditioning material is generally not closely associated with the plant nutrient-containing fertilizer in the soil, and certainly neither soil conditioner nor the fertilizer are controllably-closely associated with the seed, such that nutrient absorption benefits provided by the soil conditioning material are not assuredly associated with respective particles of inorganic chemical fertilizer materials, and neither the soil conditioning material nor the inorganic fertilizer is controllably and intimately associated with the seed as in a common capsule or other particle as in the invention.

Rather, where soil conditioning and fertilizer materials are applied in separate applications and/or in applications separate from the application of the seed, the bulk of the soil conditioning material and the bulk of the inorganic chemical

fertilizer are generally at least somewhat separated from each other in space, and physically separated from the seeds, such that potential cooperative benefit of the soil conditioning material as relates to solvation and up-take of soil moisture and/or of the inorganic chemical fertilizer by the seed are not obtained, and/or are not obtained in controlled close association with the seed.

When the soil conditioning material, the inorganic chemical fertilizer materials, and the seed are separately applied to soil with different sets of equipment, the respective rates of application vary such that the desired ratios between the quantities of the several materials are applied somewhat nonuniformly. The variances from uniformity will be different for each of the applications, thus adversely skewing the relative ratios of the materials with respect to each other at different locations in the e.g. field. Further, when applied separately to the soil, the seed and the soil conditioner are not necessarily in intimate contact with each other as they are when both materials are combined into a single combined seed capsule product as in the invention. Nor is the seed in closely controlled proximity (e.g. within the same capsule) with the inorganic fertilizer. In reality, then, any fertilizer added to the soil but not in close proximity to the seed applied to the same soil during e.g. the same growing season, is of reduced value or no value to that application of seed, whereby little or no value is realized, during that growing season, from the application of such material to the soil.

The amounts of soil conditioning material and inorganic fertilizer added to the soil at any given time represent a small fraction of the "soil" in the plant growing zone (root zone). Thus, in the conventional practice of providing separate applications of plant nutrients and soil conditioning material, in addition to the seed, only small fractions of the newly applied soil conditioning material and plant nutrient come into proximate cooperating relationship with each other and with the seed. Thus, the seed and any plant newly emergent from the seed are benefitted only to the extent the overall average root zone of the soil is benefitted by the applied soil conditioning material

Even were combinations of soil conditioner, inorganic chemical fertilizer, and seed are to be applied as separate and distinct physical product particles, using a single application apparatus and a single application process, the individual particles of soil conditioner, individual particles of inorganic chemical fertilizer, and individual particles of seed would be separated from each other to a significant degree, during the application process, such that the benefits of intimate association with each other in the soil would be lost. Indeed, the seed benefits from intimate contact with a substantial quantity of soil conditioner, but can tolerate intimate contact with only limited concentrations of fertilizer chemicals. Rather, fertilizer chemicals should in general be displaced from, but controllably located close to the seed.

In an uncontrolled application of fertilizer by an application separate from application of the seed, as in the prior art, some of the seed might be expected to be placed so close to some of the inorganic fertilizer as to be damaged by the toxic affect of such close association. Thus, the benefit of intimate contact between organic soil conditioning material, inorganic chemical fertilizer, and seed, is reduced and largely lost because of low levels of intimate association between the soil conditioning material and the seed, and unpredictable, uncontrolled levels of association between the seed and the inorganic chemical fertilizer, outside the combination of the invention, of soil conditioning coating of the seed, and optional addition of inorganic fertilizer at controlled location with respect to the seed, all in the same seed capsule, as taught herein.

By combining an organic soil conditioning material in the same seed capsule with the seed, highly effective levels of soil conditioner are assuredly associated with the seed as the seed germinates and begins to grow. Where suitable levels of plant nutrient fertilizer are incorporated into the same seed capsule, growth of the newly-germinated plant is further enhanced. In either case, the soil conditioning materials can and do tend to retain moisture and nutrients in the soil in the defined area of the seed capsule by a variety of mechanisms, providing an extended time period during which nutrients can be taken up by the plants. For example, organic soil conditioning material may retain moisture, reducing moisture drainage from the soil, such that the rate of leaching of the nutrients is, in general, reduced. Further, the soil conditioning material may absorb or otherwise physically or chemically attach to plant nutrient materials in the chemical fertilizer material, thus further retarding leaching of the plant nutrient away from the seed.

While applicant cannot place an exact time period on the increase in the extent to which the soil conditioning materials retard leaching of the plant nutrients from proximity with the seed, thereby holding the plant nutrients available for up-take by the plant, any increase in time during which the nutrients are held in the soil proximate the newly-emerging plant is beneficial to meeting the nutritional needs of the plant being so fed.

By incorporating soil conditioning materials and optionally plant nutrient fertilizers, in the seed capsules, the invention offers an efficiency of application of soil conditioning materials in proximity to the seeds most beneficially affected thereby, in a beneficial association never before available. Optional addition of plant nutrients to the same seed capsule provides a largely self-contained microcosm of seed, soil conditioner, and inorganic fertilizer in intimate yet controlled spatial relationship with each other, whereby the controlled spacings provide enhanced plant growth benefit. Namely, soil conditioning materials and plant nutrients are somewhat beneficial to each other for the overall cooperative achievement of soil fertility in the presence of the newly emerging plant which is dependent on such plant nutrients, and on moisture retained by the soil conditioner for uptake of such plant nutrients.

While soil conditioning materials do perform a number of highly interdependent tasks, one such task is in assisting in maintaining the plant nutrients in the root zone where they can be effectively used by the plants when needed. Another such task is in assisting in making the soil soft and friable in the root zone whereby the newly-emerged and very tender plant roots more readily penetrate the soil as they grow.

Where both soil conditioner and fertilizer are incorporated with the seed into the seed capsule, the soil conditioner assists in strategically maintaining the combination of soil conditioner and plant nutrients in close and controlled proximity to each other and to the seed in the soil. Such strategic placement virtually assures that the soil conditioning material and inorganic chemical fertilizer are bound to each other, in proximate relationship with the seed, for a time, such that wherever the seed capsule may land when the seed is sown, the seed will have the initial benefit of both soil conditioner and plant nutrients in intimate proximity with itself, irrespective of any condition of the surrounding growth medium. Thus, in the invention, soil conditioning material and optionally inorganic chemical fertilizer, are inherently bound to each other, and to the seed, as by the

coating process, and inherently assist the seed in achieving desired germination and strong early growth.

By incorporating the soil conditioning material in the same seed capsule with the seed, the invention ensures that the seed has benefit of intimate relationship with a beneficial amount of soil conditioner material. The seed thus receives the advantage of the beneficial amount of soil conditioner material irrespective of the overall tilth of the soil and irrespective of the overall level soil conditioner, e.g. soil texture conditioner, in the root zone of the soil with which the seed capsule becomes associated for seed and plant growth purposes.

Referring to FIG. **7**, a population of seed capsules **38** are disposed at the top surface of a cross section of soil. Root zone **150** of the soil is generally defined to that depth of the soil which typically receives roots of growing plants, and is generally defined within 20–30 inches of the top surface of the soil. Generally, and preferably, the root zone should have a soft texture, rich in organic and/or other soil conditioning material in order to provide good tilth, and desirable moisture and nutrient holding properties. Underlying root zone **150** is subsoil **152** which typically contains little organic matter.

It is a well known agricultural phenomenon that, in soil used for intensive crop production, the root zone tends, over time, to become relatively depleted of organic soil conditioning material, illustrated at **154** in FIG. **7**, negatively affecting soil tilth and texture. While wholesale addition of organic soil conditioning material can improve the overall tilth of the soil, FIG. **7** illustrates application of the invention wherein the texture of the material immediately adjacent the seed, namely coating **42**, provides beneficial properties attributable to soil having desirable texture.

FIG. **8** illustrates that coating **42** draws moisture **154** from the soil, into the capsule, where the moisture is available to assist in germination of seed **40**. In the process, traverse of the moisture through second coating **46**C releases plant nutrient material into the moisture, as well as downwardly into the soil adjacent the seed capsule, as illustrated at **156**. Thus, the root **158** emerging from the seed emerges into an initial growth medium, coating **42**, having texture, moisture, and plant nutrient highly advantageous to early plant growth. As root **158** advances further downward, the upper portion of the underlying soil under the capsule where the seed first enters the soil, has also been beneficially affected to the good of the plant by plant nutrients **156**, and by moisture attracted or held in the vicinity of the capsule, as a result of the presence of the soil conditioning material in the capsule.

The relative amounts of the soil conditioning material and the inorganic chemical fertilizer material in the seed capsule vary significantly in accord with the specific application, and any specific interactivity desired of the soil conditioning material and inorganic chemical fertilizer. For example, in a particular combination of soil conditioning material and inorganic fertilizer a particular plant crop to be nourished by the product may require a higher amount of plant nutrient, or a specific analysis of plant nutrients, in order to be properly fed at and shortly after the stage of germination.

Thus, for a given specific application of combination seed capsule (with fertilizer) product of the invention, the relative amount of inorganic chemical fertilizer, and the fertilizer analysis, may be increased or decreased from some "standard" in the interest of achieving a functionally adequate feeding of the newly germinated seedlings. Namely, the NPK etc. nutrient levels provided in a given seed capsule product of the invention can be set and controlled at the fertilizer manufacturing plant in accord with the respective NPK etc. nutrient needs of the seed to be supported, or of the soil or other growth medium to which the combination fertilizer of the invention is to be applied.

In any embodiments, whether or not specifically discussed here, the fabricated seed capsules are kept sufficiently cool, and are kept sufficiently dry, to avoid the seed capsules sticking to each other, caking, and the like, and to prevent premature germination of the seed. Where liquid is used to obtain the coating material in liquid state, sufficient liquid is removed during or shortly after the coating step to avoid the seed capsules sticking to each other, or caking, or the like. Where the seed capsules are made by process other than the process described here, the details of the process will determine proper cooling, drying, or other steps to provide a finished, dry, solid seed capsule or like product. A dry such product generally has moisture content less than 10% by weight, preferably less than 5% by weight, most preferably less than 3% by weight.

As suggested by the description hereinabove, the processes of the invention are generally carried out to make combination seed improvement products solely by using physical processes such as coating and drying. While some minor chemical reactions may inadvertently accompany such physical processes, the invention does not rely on any chemical reaction for achievement of the objectives thereof. Rather the invention is focused on a physical combination of starting materials, which physical combination results in mutual benefits of the two starting materials (seed and soil conditioner, and optional inorganic chemical fertilizer) functioning intimately together, in primarily physical and physico-chemical relationship, to produce an overall increase in benefits of plant germination and early plant growth with such combination seed improvement products.

The relative amounts of seed and coating material depend on the overall benefits desired to be achieved from the coating operations. In general, the seed will comprise from about 0.1% to about 75% of the overall weight of the seed capsule. the coating material thus represents about 25% to about 99.9% by weight of the seed capsule. Where the seed content is low, the general benefit of the product is that of soil conditioning, with some seed application. Such product is well suited for application to e.g. a healthy lawn for general improvement of soil condition, and modest fill-in of bare spots with seed.

Another benefit of low seed content by weight, especially with quite small seeds, is in creating a larger size seed capsule, and thereby facilitating the handling of such seed in commonly-used seed handling machines such as grain drills or seed broadcast machines.

Typically, however, a higher seed content is preferred so as to have major impact on the number of plants which are caused to germinate by application of such product. Thus, for a seed about 0.5–1.0 mm thick and about 4–7 mm long, a preferred fraction of seed is about 1% to about 50%, preferably about 1.5% to about 20%, more preferably about 2% to about 10% by weight seed, with respective amount of soil conditioner and optionally fertilizer. For example, in a preferred product of the invention, an above mentioned grass seed about 0.5–1.0 mm thick and about 4–7 mm long, when coated produces a seed capsule about 4 mm across and about 6–9 mm long. Smaller, or larger, seed capsules may be made and used as desired.

The size and density of the seed capsules can be readily controlled using conventional sizing equipment and processing parameters of the coating process, so as to provide a uniform product of a wide range of sizes and densities. With the size and density of any seed thus controllable, the size and density may be selected and specified for enhancing control and efficiency of seed handling and/or distribution. For example, tiny seeds such as lettuce, carrots, cabbage, and alfalfa, may be sized and weighted for easy and assured handling and distribution, whether by hand or by machine. Seeds which are non-aerodynamic, or which are so light as

to be blown around, such as grass seed, can be made heavy and compact enough as to assuredly remain on location where sown after being planted. For example, non-aerodynamic seeds, after treatment according to the invention, can be broadcast-applied using conventional equipment such as is used to broadcast apply granular fertilizer over e.g. 40 foot wide application paths.

Where time controlled germination is desirable, a population of combination seed capsules, having at least one soil conditioner and one or more nutrients, can be planted in conjunction with noncoated seeds. As a result, non-coated seeds will germinate at an earlier stage than the population of combination seed capsules. Such staggering of germination times allows, for example, the noncoated seeds to use the available soil nutrients with less competition (i.e. less seeds using limited nutrient supply). At a later time, when the coated seeds germinate, such seeds can use the nutrients leached from their combination seed capsules to germinate.

Where e.g. small such seeds are desirably planted in close proximity with each other, and wherein a relatively larger size seed capsule is desired for ease of handling such that the large size seed capsule would potentially interfere with such close placement of the seeds with respect to each other, then and in such situation, multiple seeds may be employed in individual seed capsules, e.g. generally uniformly distributed throughout the seed capsule, so as to provide for sufficiently close spacing of the seeds from each other.

Paper mill sludge, as is suggested as a coating material herein, is a resultant by-product of papermaking, typically from e.g. a de-inking process in the paper mill.

By utilizing paper mill sludge and/or sewage sludge as taught herein, one contemplates beneficially and suitably disposing of significant quantities of industrial waste which otherwise is disposed of by landfilling.

Where the product of the invention is applied as to a residential or like lawn, as in an agricultural field, the seed is applied to the soil in intimate combination (seed capsule) with the soil conditioner, such that the soil conditioner serves as moisture retainer and sun shield. In addition, the seed capsule is much heavier and dense than the seed itself, whereby the seed capsule provides substantial protection against the seed being washed away in surface water run-off. Thus, the coating about the seed serves many of the functions typically performed by the conventionally-used straw mulch. Accordingly, product of the invention can be used to seed new lawns without any need for use of straw or any other mulch material.

Where seed is desirably used to fill in bare spots in the lawn, such seed, especially fertility-enhanced seed capsules, may be applied desirably in one of two ways. First, the coated seed capsule product may be applied only to perceived bare spots, without use of straw. The soil conditioner in the seed capsules serve the functions of the straw as described above, but perform better than straw because of the close association between the seed and the soil conditioner.

In the alternative, the coated seed capsule product may be broadcast generally over the entire lawn. Where the lawn is already healthy with thick grass growth, the soil conditioner and fertilizer will benefit the existing grasses, with minimal germination and growth of new seed from the seed capsules. Where the existing grass is thinner, the seeds in the seed capsules will have room and light to grow, whereby the combined properties of seed, soil conditioner, and fertilizer, in intimate relationship with one another, will be efficaciously used.

Where seed capsules of the invention are used to establish a new lawn, the soil conditioner in the seed capsules serve the functions of the straw as described above, obviating the need for straw in establishing the lawn seeding.

Those skilled in the art will now see that certain modifications can be made to the apparatus and methods herein disclosed with respect to the illustrated embodiments, without departing from the spirit of the instant invention. And while the invention has been described above with respect to the preferred embodiments, it will be understood that the invention is adapted to numerous rearrangements, modifications, and alterations

To the extent the following claims use means plus function language, it is not meant to include there, or in the instant specification, anything not structurally equivalent to what is shown in the embodiments disclosed in the specification.

What is claimed is:

1. A combination seed capsule comprising:

one viable seed;

said seed acting as a core or pseudo core of said combination seed capsule;

a coating of a composition comprising soil conditioning materials;

said soil conditioning materials being in a solid state at time of coating.

2. The combination seed capsule of claim **1** wherein material of said soil conditioning materials are comprised of sludge or fly ash.

3. The combination seed capsule of claim **1** wherein the material is a fiber containing byproduct of a paper making process.

4. The combination seed capsule of claim **3** wherein the byproduct is paper sludge.

5. The combination seed capsule of claim **1** wherein the soil conditioning materials is comprised of municipal sewage.

6. The combination seed capsule of claim **1** wherein the soil conditioning materials are comprised of sawdust.

7. A combination seed capsule comprising:

one viable seed;

said seed acting as a core or pseudo core of said combination seed capsule;

a coating of a composition comprising soil conditioning materials;

said coating being applied to said viable seed by an agglomeration operation;

wherein said soil conditioning materials are in a solid state at time of coating.

8. The combination seed capsule of claim **7** wherein material of said soil conditioning materials are comprised of sludge or fly ash.

9. The combination seed capsule of claim **8** wherein the material is a fiber containing byproduct of a paper making process.

10. The combination seed capsule of claim **9** wherein the byproduct is paper sludge.

11. The combination seed capsule of claim **7** wherein the soil conditioning materials is comprised of municipal sewage.

12. The combination seed capsule of claim **7** wherein the soil conditioning materials are comprised of sawdust.

13. The combination seed capsule of claim **7** wherein a binder is applied to said seed capsule.

14. The combination seed capsule of claim **13** wherein a fertilizer is part of said soil conditioning materials, said binder or its own layer.

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